

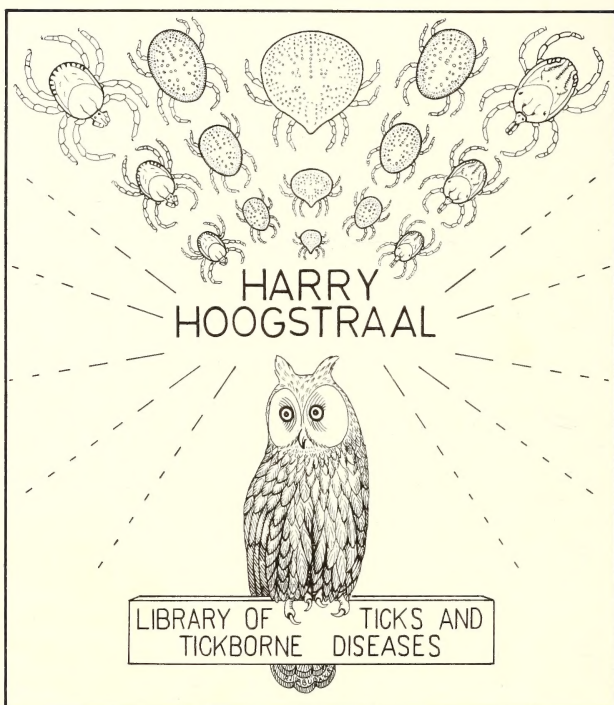
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A LIST OF THE TICKS OF SOUTH AFRICA,

With Descriptions and Keys to all the Forms known.

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There are probably none of the external parasites of domestic animals of more importance to the stock raiser in South Africa than the ticks, owing to the large number of diseases which they transmit from animal to animal. The ticks of South Africa have, however, only been studied with regard to their connection with the transmission of diseases, and very few people are aware of the distinction between the various species and the various forms of the same species.

With a view to throwing a little more light on these creatures, and mainly of assisting the work of those interested in the study of the diseases referred to, a study of the ticks of South Africa was taken up by me about three years ago while in the Transvaal. Since then a large number of the life histories of these ticks have been worked out, and their immature stages carefully studied and compared. There are still many species which I have not been able to see owing to the rareness with which they occur, but in such cases I have compiled the literature from other authors and placed it in such shape as I consider will prove useful to the South African workers. There is still an immense amount of work to be done on this subject, and my only plea for placing this paper before the public is in the hopes that it will arouse more interest in such studies, and consequently advance the work.

FAMILY IXODIDAE.

The ticks or *Ixodidae* are distinguishable from the other families of the order *Acarina* by the following characters:—

They are always large enough to be visible to the naked eye, flat when young, more or less swollen when fully engorged with blood; the females almost always larger than the males, often attaining in certain species the size of a hazel nut. The integument is always coriaceous, and usually of a dull colour, such as brown or reddish-brown, but sometimes adorned with bright colours and designs.

The *rostrum* comprises (1) two *mandibles*, each formed of a shaft, the lower half of which is swollen to receive the insertion of muscles, while the upper half is flattened and narrow, terminated in front by a finger or digit, recurved in a hook at its tip. The base of the digit is wide and swollen; on its dorsal surface it bears two unequal apophyses, each with one or more processes and teeth, recurved, one of which is always terminal. These mandibles are wrapped throughout their full extent in a membranous sheath, a prolongation of which extends over the digit; (2) a *hypostome* shaped like a dart, armed on its lower face with backward projecting teeth placed symmetrically on each half; (3) two *palpi* composed of four articles each.

Respiration is by tracheal tubes opening to the exterior through two stigmata, surrounded by stigmatic plates, circular or lunate in outline, and situated near the fourth pair of coxae.

Legs with six articles (seven or eight by the apparent division of one or two articles into two parts); coxae immovable; tarsi provided with two claws, with or without a sucker-like disk called the *ambulacre*. The tarsus of the first pair bears on its dorsal edge, near the distal extremity, a cup-like depression, the organ of hearing known as "Haller's organ."

Larvae with six legs, without sexual orifice, and without large stigmatic plates; respiration takes place through one to four pairs of small openings along the lateral edges.

Nymphs with eight legs, and no sexual orifices; two large stigmatic plates present.

The members of the family live as parasites on mammals, birds, and land reptiles, the blood of which they suck by fixing their rostrum into the skin. The hypostome is provided with teeth, which, with the teeth of the mandibles, hold it in place. The palpi spread outward and apply themselves to the skin on each side, and at right angles to the point of piercing. The females leave the host to lay their eggs in some protected place on the ground, such as under a clod of earth, stones, or rubbish.

The family *Ixodidae* is sub-divided into two distinct groups or sub-families, the *Argasinae* or fowl ticks, and *tampans*, and the *Ixodinae* or true ticks.

A. Rostrum inferior, hidden under a frontal projection of the body; no anal plates; no pulvilli at tips of tarsi *Argasinae*.

AA. Rostrum terminal at anterior end of body; a dorsal shield present; tarsi with pulvilli *Ixodinae*.

SUB-FAMILY ARGASINAE.

Rostrum inferior (except in the larvae, when it is often terminal, or nearly so, and in the nymphs, when it is sub-terminal, part of it projecting beyond the anterior end of the body), that is, the rostrum is situated on the ventral surface of the anterior end of the body, which projects over it like a hood. The digit of the mandibles is irregularly triangular, wide and swollen at the base; the inner apophysis is elongated, with the terminal tooth recurved outward, and the process more or less transverse, pointed at both extremities and inserted at about the middle of the length of the apophysis; the outer apophysis is elongate, provided on its outer edge with two large teeth, similar in form and almost parallel. The palpi are free, elongate, and cylindrical; the articles differing little from one another. The legs are a little unequal in length, the second pair is the shortest, the fourth pair the longest; six articles, the third and the tarsi

(except those of the first pair), show a false articulation at a distance from their proximal ends, equal to their diameters; the coxae are contiguous, or almost so; the tarsi are not provided with pulvilli. The integument is of a colour varying from dirty yellow to dark brown; there are no chitinous plates, either as dorsal shield or ventral or anal plates; the integument instead is adorned with pits, furrows, and sculptures of various forms. The stigmatic plates are situated between the last two pairs of legs, laterally and dorsally of the coxae. The sexual pore is ventral, median, transverse, and situated opposite the intervals between the first two pairs of legs; in the male the pore is narrow, almost as long as wide, and semi-lunate; in the female the pore is an elongate slit almost as wide as the rostrum, with its edges parallel; otherwise the two sexes are almost indistinguishable from each other, except that in general the males are considerably smaller than the females, and do not distend to such an extent after feeding. The nymphs are very similar to the adults, except in lacking the sexual openings.

The members of this family are parasitic on mammals, but especially on birds. There are two genera, *Argas*, the fowl and bird ticks, and *Ornithodoros*, the tampan and sand ticks.

Adults and Nymphs.

- A. Body usually flat, and thin at the edges; no deep furrows on the ventral surface; no eyes *Argas*.
 AA. Body thick at the edges; ventral furrows present; eyes present or absent *Ornithodoros*.

Larvae.

- A. Body thin; larvae active *Argas*.
 AA. Body thick and swollen; larvae not active, or only so for a short time, at least they never feed *Ornithodoros*.

GENUS ARGAS, LATREILLE.

Argas, Latreille (1796).

Rhynchoprion, Hermann (1804).

Argas, Latreille (Neumann, 1896).

Body flat; general contour usually oval with rounded extremities, sometimes orbicular, the anterior extremity narrower than the posterior, widest behind the fourth pair of coxae. Anterior end of the body projects beyond the capitulum like a hood. Lateral edges thin or a little thickened. Integument without papillæ, but somewhat roughened by irregular zigzag wrinkles or folds, which are absent only at certain points, occupied by nearly circular pits; these are shallow, more or less numerous and scattered, the larger ones form radiating series on both dorsal and ventral surfaces, of which the median posterior row is longest. Eyes absent.

This genus includes the fowl tick and bat tick. They are easily recognised by their flattened bodies, which cause them to look not unlike bed-bugs. The edges of the body are very thin, and formed by a series of folds or rectangular plates. On both upper and lower surfaces there is a system of shallow shiny pits, with raised edges, grouped into lines radiating from a central point.

These ticks are nocturnal in their habits ; usually parasitic on birds, fowls, bats, and sometimes man, and are found in places frequented by these animals. They are admirably adapted to their life, for their thin bodies can easily be concealed in cracks about fowl-houses or under the bark of trees.

There are only a few species belonging to the genus, and they resemble each other very closely. Three species occur in South Africa, which can easily be separated by the following keys :—

Adults.

- A. Body almost circular in outline, as wide in front as behind. *vespertilionis.*
- AA. Body oval in outline, longer than wide, and narrower in front.
 - B. Edge of body formed of a border of rectangular plates. *persicus.*
 - BB. Edge of body formed of a series of irregular wrinkles. *transgariëpinus.*

Nymphs.

- A. Body almost circular in outline *vespertilionis.*
- AA. Body oval in outline . . *persicus*, and probably *transgariëpinus.*

Larvae.

- A. Body truncate in front *vespertilionis.*
- AA. Body not truncate in front. *persicus*, and probably *transgariëpinus.*

ARGAS PERSICUS, FISCHER DE WALDHEIM.

Argas persicus, Fischer de Waldheim (1823).

Argas persicus, Laboulbene et Megnin (1882).

Argas persicus, Fischer de Waldheim (Neumann, 1896).

Plate I, figures *f, g, h, i*, Plate II, figures *c* to *n*.

Adult.—*Body* oval ; dull yellowish or reddish-brown, or often blueish-black in colour, varying in accordance with the amount of blood taken into the digestive apparatus. *Dorsal surface* (*II, c*) excavated, flat or convex, according to the state of engorgement ; on each surface a border formed of rectangular plates, in the centre of each of which is a circular pit containing a small spine ; numerous shiny pits on the dorsal surface, in the anterior quarter two large oval pits, rather close to the median line, diverging in front, surrounded by concentric folds, behind these two similar pits, a little further removed and on each side of these, three or four others forming a transverse semi-circular series, with the concavity posterior, behind these a similar semi-circular series, then several straight lines in the posterior half, radiating from a central point, and unequal in length, one of this series median, uninterrupted, extending from the border almost to the centre, five or six short rows on each side, of unequal lengths, some approaching nearer the centre than others ; numerous small pits are scattered here and there on the remainder of the dorsal surface, a row two or three deep inside the marginal border at

either extremity. Arrangement of the rows of pits on the *ventral surface* approximately the same as on the dorsal surface; the remainder of the integument formed of zigzag folds passing between and surrounding the pits. Stigmatic plates (*II, n*) semi-lunate, transverse, opposite Coxae IV. Anus a short distance posterior of the level of Coxae IV, elliptical, seven hairs on the edge of each valve. *Rostrum* (*II, b*) short, set in a pit near anterior end of the body, just anterior of first pair of Coxae; base rectangular, nearly as wide as long; mandibles (*II, l, m*) with process of inner apophysis tridentate, outer apophysis short, with three teeth, the anterior of which is small and sub-terminal; hypostome notched at its extremity, in the females (*II, k*), on each half, at the tips five to seven small teeth in two transverse lines, then four strong teeth, disposed two and two, and followed by three smaller teeth, below which is a series of teeth becoming smaller and smaller and in three, four, and then five longitudinal rows, which do not extend to the external border nor further than the middle of the length of the hypostome; in the male (*II, j*) eight small teeth at the tip, followed by six large teeth in twos, then three small teeth arranged irregularly, below which is a series of small blunt teeth as in the female; palpi elongate, the second article perceptibly cylindrical, on their ventral side a few small hairs, and on their dorsal side numerous long hairs with denticles on the convex edges of the hairs, these hairs a little more abundant on the first article than on the second, still less numerous on the third and very few on the fourth, the extremity of which is truncate and a little concave, and bears twelve to fourteen blunt, cylindrical spines; four long hairs at the base of the rostrum, two of which are near the insertion of the palpi. Sexual opening in female, long transversely and narrow, situated between Coxae I, in male half as long as in female, wider, and situated opposite first inter-coxal space. *Legs* with Coxae slightly striated, those of the first pair a little removed from those of the second, second article cylindrical, almost as wide as long; the others a little flat dorsoventrally; the third and fourth elongate, truncate, narrower at the distal extremity, the other two with parallel edges, the third longest, the three others of almost the same size; tarsi with the dorsal protuberance usually indicated by a basilar constriction; short hairs on all the articles except the coxae.

Female up to 10 mm. long by 6 mm. wide; very flat when young; of a thickness in the centre almost equal to the half of its width when it is engorged. The male may reach 5 mm. long by 3 mm. wide, with the same depressions as the female.

Nymph resembles the adult, but without the sexual orifice; anus wider than in larva, five to seven spines on each valve. Mandibles like those of adult; hypostome (*II, i*) with five to eight small teeth at tip on each half, then five large teeth, followed by a series of small blunt teeth, growing smaller posteriorly and in rows of three, then four.

Larva (*I, f*) (unengorged), oval in outline, broadly rounded behind and more narrowly rounded in front; 0.66 to 0.70 mm. long by 0.50 mm. wide; flattened, with marginal and central part of dorsal surface slightly raised; light yellowish or greyish in colour, becoming nearly translucent at the margin, from which colourless lines extend toward the centre; a lighter shield-shaped area on the dorsal surface over the rostrum; surface of body with fine parallel transverse and slightly undulating striae; no pits; edge of body with a marginal row of short folds; numerous large,

stout, translucent hairs on dorsal surface, more numerous anteriorly and near lateral margins, where some are set on the lateral edge, all projecting backwards. Anus at the posterior third of length, elliptical in outline, one very long, slender spine on each valve; six stout spines surrounding anus at short distance from it, otherwise no spines on ventral surface. *Rostrum* set in a slight pit with rim raised anteriorly and laterally; only the base covered by the body, remainder projecting beyond the anterior edge. Mandibles as in nymph; hypostome spatulate, rounded at tip, on each half nine small teeth at the tip in three transverse rows, then one transverse row of four teeth, followed by one or two rows of three teeth each, then two large teeth in each row to near the base of the hypostome; palpi free, cylindrical, curved downward, article I as wide as long, articles II and III longer than wide, article IV conical, numerous long translucent hairs on all the articles, those on articles II and III dentate, a tuft of terminal hairs on article IV. *Legs* stout; equal in length; numerous long hairs; coxae contiguous; tarsi very long, not so abruptly truncate at tip as in adult; claws long. (Engorged) length, 2 to 3 mm. by 1.5 to 2 mm. wide, dark blueish in colour, more oval in outline than when unengorged, and resembles nymph, except that it lacks the radiating rows of pits, having instead furrows which correspond to the rows of pits in nymphs and adults.

Eggs nearly spherical, 0.5 mm. long, surface smooth, colour at first bright yellowish brown, then dark chestnut brown.

Hosts.—Fowls, ducks, geese, turkeys, pigeons, secretary bird, ostrich, canary, and man.

Habitat.—All the north-east and north-west parts of Persia, Turkestan, Russia, Egypt, Algeria, Cape Colony, Orange River Colony, Transvaal, Mozambique (and probably all of South Africa), and Australia.

This tick is pre-eminently a pest of fowls, although found occasionally on the other birds and animals mentioned. There is scarcely a fowl-house in the Transvaal which is entirely free from it, and where fowls are allowed to roost in trees the bark of such trees will be found to conceal countless numbers. The nests of many of our wild birds are also often infested. In South Africa it does not, however, seem to be common close to the coast. The same fact has also been noted in Australia.

The larval ticks are easily transported from one place to another due to their habit of remaining on a fowl for five to seven days before becoming engorged and dropping off. Thereafter feeding takes place only at night, and lasts only for half an hour to two hours. Both sexes moult three times before becoming adult, and while adult, they may feed as many as six times. The males differ from the females only in size, being much smaller, and in having the genital pore wide, instead of a narrow elongate slit.

Adult ticks have been known to live in vacant fowl-houses as long as thirty-seven months without food, and still be capable of oviposition after a good feed, while larvae have been left without food for eight months, and still survived.

This *Argas* will probably be found to convey some diseases of fowls, but its greatest injury seems to be in causing loss of blood. In a badly

infested fowl-house this loss is often so great as to cause fowls to die in large numbers. Travellers in the Middle Ages frequently referred to this tick as causing sickness, and even death, to human beings in Persia. In fact it frequently became so numerous in houses in that country as to make it necessary for entire villages to move and construct new dwellings elsewhere.

ARGAS VESPERTILIONIS, LATREILLE.

Carios vespertilionis, Latreille (1796).

Caris vespertilionis, Latreille (1804).

Argas fischeri, Audouin (1827).

Argas pipistrellæ, Audouin (1832).

Caris vespertilionis, Gervais (1844).

Caris elliptica, Kolenati (1857).

Caris longimana, Kolenati (1857).

Caris decussata, Kolenati (1857).

Caris inermis, Kolenati (1857).

Argas fischeri, George (1876).

Argas pipistrellæ, Westwood (1877).

Argas vespertilionis (Latreille) (Neumann, 1896).

Plate I, figures *h* to *p*; Plate II, figures *p* to *w*.

Female (*I, m*).—*Body* nearly circular, often somewhat wider than long (9.5 mm. wide by 8.5 mm. long); posterior edge in some cases nearly straight; anterior edge terminating in a point and produced into a narrow hood covering the rostrum; colour dark greyish blue when fully engorged, when not it is yellowish brown, lighter about the edges; legs light brown; integument roughened with numerous papillae; on the margin a border of elongate, quadrangular plates each with a short hair (*I, o*); irregularly disposed, narrower anteriorly; numerous shiny pits on the dorsal surface near the anterior third, two pits far apart, in front of them another pair further apart and another pair still more anterior and further apart, two rows of small pits extending anteriorly between these large pits; from posterior pair of pits a V-shaped groove opening anteriorly and continued posteriorly by a single groove to posterior third; on each side of this single groove is a very large deep pit with a smaller one more anterior, a wide row, two or three deep, of shiny pits extending along inner edge of margin, and from this numerous rows of pits, alternately long and short, extending inwards as if radiating from the centre. *Ventral surface* with a pair of well marked genital grooves and a narrow marginal groove with pits in their depth; radiating rows of pits as on dorsal surface. Genital pore elongate transversely and narrow, opposite posterior margin of Coxae I; anus just posterior to Coxae IV, elliptical, no spines surrounding it, but six spines on the edge of each valve; stigmatic plates uniform, opposite Coxae IV. *Rostrum* concealed under dorsal hood and set in a pit, into which it can be retracted; base rectangular, much larger than wide; hypostome, conical, a single row of sharp teeth extending along the lateral edges, increasing in size from anterior to posterior part; mandibles (*II, s*) very elongate and narrow, at least twice as long as those of male, process of inner apophysis lacking, outer apophysis bidentate; palpi very short, article I somewhat longer than

wide, other articles as long as wide, article IV conical; long hairs on outer and distal margins of all articles, terminal tuft of hairs on article IV. *Legs* slender and very long, pair IV longest; Coxae elongate, removed from median line, pairs II, III, and IV contiguous, pair I removed anteriorly; article I longer than wide, other articles all very long and slender; tarsi gradually attenuated at tips; all articles with numerous whitish hairs; claws very long and slender.

Male (I, l).—Resembles the female except for the following points: much smaller, 5.5 mm. wide by 5.5 mm. long; somewhat narrower in front than behind, but lacks the conical anterior prolongation of the female; integument with papillae not so strongly formed; a pair of large pits on the dorsal surface on each side of the median line at about the anterior third of the length, in front of these another pair of pits, further removed from the median line, with a third pair still further anteriorly and more widely separated, behind the first-mentioned pair another pair of pits, more widely separated; numerous radiating rows of pits as in female; anus with eight long spines on each valve, close to the anal ring; genital pore short transversely, opposite Coxae I; deep coxal grooves; mandibles (*II, r*) short and thick, process of outer apophysis bidentate and attached low down, outer apophysis bidentate; hypostome (*II, v*) with three rows of small teeth on each side at tip, first row consisting of two teeth, other rows of four teeth each, then a row of three larger teeth, followed by a row of two very large teeth each. *Legs* shorter and stouter than in female; pairs I and IV longest; Coxae contiguous; article I as wide as long or about so; other articles much longer than wide; claws of tarsi shorter than those of female.

Nymph (I, n).—Body almost circular, may reach 2.4 mm. long by 2.1 mm. wide, narrowly rounded anteriorly, which acts as a hood in covering the rostrum. Integument marked with fine zigzag folds on young individuals, but with papillae on those which are older; on each surface a border, formed of irregular folds on young individuals, elongate quadrangular plates on those more mature, narrower anteriorly, plates bearing very short hairs, irregularly disposed. Arrangement of pits on dorsal and ventral surface as in the male; other characters like those of male except as follows: anus with five spines on each valve; deep transverse groove immediately posterior to the anus; the extremities of the rostrum often appear beyond the anterior edge of the body; process of inner apophysis and outer apophysis inserted very anteriorly, otherwise resembles those of the male; hypostome (*II, u*) provided on each half with two longitudinal rows of five or six strong teeth each; two long hairs at the base of the rostrum, near the median line, two others shorter, more posterior, and more widely separated, on the prolonged axes of the palpi.

Larva.—*Body* short, oval, truncate in front; 1.3 to 2 mm. long by 1 to 1.5 mm. wide; colour varying from light dirty yellow to reddish, deeper in centre, bluish when engorged; legs lighter in colour; flat, with the margin and the centre of the dorsal surface raised; ten radiating grooves in the posterior half of the dorsal surface and a somewhat larger number in the corresponding part of the ventral surface. *Integument* marked with fine folds, parallel, transverse, a little undulating. On each side of the *dorsal surface* three hairs, distributed symmetrically in the anterior half; twenty

hairs, distributed on the circumference, four at the truncated anterior end, two pairs of sternal hairs; seven hairs around and at a certain distance from the anal ring; a strong hair on the anterior edge of each anal valve. *Rostrum* elongate; only its base covered by border of the body; the rest projecting anteriorly beyond the body; mandibles similar to those of the nymph, but the inner apophysis inserted lower down, near the middle of the digit, as in the male; hypostome (*II*, *t*) narrow, long, pointed at the extremity, armed on each half near the tip with four longitudinal rows of teeth, the inner rows composed of weak, the outer rows of strong and sharp teeth, below these two rows of large teeth one of which is marginal and formed of ten to twelve teeth, extending to the base of the hypostome; palpi slender and free; the first article a little longer than wide, the other three twice as long as wide, the fourth small, cylindrical, with four or five terminal spines; the second and third with four dentate hairs on their external borders; four short hairs on the base of the rostrum and placed as those on the nymph. *Legs* almost equal in length; Coxae almost contiguous, very far from the median line, elongate; second article as long as wide; the other four cylindrical; the tarsi longest, similar to those of the nymph; the hairs semi-denticulate, on all the articles.

Hosts.—Bats: *Mineopterus schreibersi*, (Pretoria), *Vesperugo pipistrellus*, *Plecotus auritus*, *Vesperugo kühli*, *V. noctula*, *Myotis murinus*, *Rhinolophus clivus*, *R. hippos*, *Brachyotus dassyne-mus*, *Synotus barbactellus*; Man.

Habitat.—England, France, Egypt, Tunis, Cape Colony, Transvaal. As this tick occurs in Egypt and also in South Africa the probability is that it will be found in other parts of Africa also.

This tick is not often seen, probably because the hiding places of bats are seldom searched for them. I feel sure, however, that they are very common throughout South Africa, and natives have told me that they have found them under bark of trees in the bush.

Out of several hundreds of specimens which I have collected I have found only one adult female. The life history seems to be very much like that of *A. persicus*; larval ticks can be found in numbers, in all stages of engorgement on bats. When a house becomes a hiding place for bats, these ticks may become so numerous as to cause considerable annoyance to the occupiers, for to those sensitive to insect bites, the bites of these ticks cause considerable pain and swelling of the portions of the body bitten. In Tunis it has been found that this species may transmit a spirillum of bats.

ARGAS TRANSGARIEPINUS, WHITE.

Argas transgariepinus, White (1846).

Argas kochi, Neumann (1901).

Argas transgariepinus, White (Neumann, 1906).

Male.—*Body* flat, thin, in a wide oval, almost as wide in front as behind; length 7.5 mm., width 6 mm.; brownish red, legs and rostrum lighter. *Dorsal surface* convex, excavated along the edge, which is raised; integument finely chagreened. On each surface a

relatively large border (0.3 mm.) formed of irregular radiating wrinkles. On the dorsal surface numerous shiny pits, forming radiating lines in the posterior third of the surface, at the anterior quarter of the length two large oval pits close to the median line, about them an interrupted circle of small pits, outside this circle in nearly all of the anterior quarter, up to the margin, numerous, unequal irregular pits, mostly small and continued behind by two or three rows within the margin. Ventral surface a little concave, with shiny pits not very apparent; anus about the middle of the length, opposite the stigmatic plates, which are scarcely its diameter; sexual orifice very small, opposite the posterior extremity of coxae I. *Rostrum* very small (0.5 mm.), very near the anterior edge, and removed from coxae I; its base longer (0.5 mm.) than wide, lodged in a cavity; hypostome narrow; palpi short. *Legs* short; lines of the coxae distant from each other, enclosing between them about one-third of the width; coxae I distant from coxae II; tarsi I with a very large prominence near their extremity, the others terminating in a feather edge, with the dorsal, sub-terminal prominence almost obsolete.

Hosts.—Probably fowls and birds.

Habitat.—South Africa (probably north of the Orange River); Basutoland.

I have never seen specimens of this species, and the description is, therefore, taken from that of Neumann. Professor Neumann has recently noted that his *A. kochi* differs slightly from *A. transgariëpinus*, in having the prominences on all of the tarsi, instead of only on tarsi I, as in *transgariëpinus*, although not quite as prominent as on tarsi I, of this latter species. If this proves to hold true for both sexes, *A. kochi* will become a variety and not a synonym of *A. transgariëpinus*.

GENUS ORNITHODOROS, KOCH.

Ornithodoros, Koch (1844).

Ornithodoros, Koch (Neumann, 1896).

Body sometimes oval; generally with lateral margins straight and parallel, or almost so, sometimes concave; prolonged in front in an angle more or less marked from the point of insertion of the second pair of legs; rounded on the posterior margin. Hood recurved on the ventral surface, where it is hollowed out in a pit for the insertion of the rostrum with thick edges. Edge of the body thick, with the two surfaces not differentiated. Integument with prominent hemispherical papillae arranged in various designs; the dorsal surface bears various depressions; on the ventral surface folds and grooves constant; two longitudinal folds known as *coxal folds*, similar, prominent, situated opposite the inner extremities of the coxae, and disappearing behind the last pair of coxae; two similar longitudinal folds, known as *sub-coxal folds*, situated above and outside of the coxae; a transverse *pre-anal groove*; another transverse *post-anal groove*; a longitudinal groove known as *anal groove* extending from the anus to the post-anal groove; eyes sometimes present.

Four representatives of this genus are reported from South Africa, only one of which is found in the Transvaal, *O. savignyi caecus*. *O. savignyi pavimentosus* is found in German South-West Africa, where *caecus* is also supposed to exist. *O. talaje capensis* is limited in its distribution, being confined to the islands off the west coast of Cape Colony where penguins are abundant.

The four varieties may be separated by the following key:—

Adults and Nymphs.

- A. Body short, oval; widely rounded at both extremities; several teeth upon tarsi and article V of legs. Rostrum without prominent lateral cheeks to form a partial hood for it.
- B. Eyes present.
 - C. Teeth upon tarsi and article V of legs, well separated, higher than wide and rounded *savignyi*.
 - CC. Teeth upon tarsi and article V of legs, closer together, wider than high and more quadrilateral in outline *savignyi pavimentosus*.
- BB. Eyes absent; teeth on coxae as in *savignyi*
 - savignyi caecus*.
- AA. Body elongate and narrow, pointed on the anterior end; rostrum with prominent lateral cheeks, which partially cover it; no teeth upon coxae or article V of legs
 - talaje capensis*.

Larvae (only known of two species).

- A. Length 1.66 mm.; width 1.3 mm. *savignyi caecus*.
- AA. Length 1 to 1.5 mm.; width 0.75 to 1 mm.
 - savignyi pavimentosus*.

Eggs.

- A. Eggs of a reddish brown colour—0.9 mm. by 0.8 mm.
 - savignyi caecus*.
- AA. Eggs of a darker colour—1.4 mm. by 1.0 mm.
 - savignyi pavimentosus*.

ORNITHODOROS SAVIGNYI, (AUDOUIN.)

Argas savignyi, Audouin (1827).

Ornithodoros savignyi, Koch (1844).

Ornithodoros morbillosus, Gerstäcker (1873).

Argas moubata, Murray (1877).

Argas schinzii, Berlese (1889).

Ornithodoros savignyi (Audouin) (Neumann, 1896).

Adults.—*Body* a short oval in outline, widely rounded at both extremities, sometimes a little constricted at the sides, at the plain of the third and fourth pairs of legs; colour ochreous yellow when young, darker and even brownish black when adult, the legs of a lighter colour; *integument* covered with granulations varying with the size of the creature itself; hairs abundant, placed between the

granulations, more numerous on the ventral than on the dorsal surface, most numerous in the region of the rostrum, more numerous on individuals of medium size than on young or engorged females. On the *dorsal surface* a median prominence limited behind by a transverse groove near the posterior quarter of the length, and crossed in its middle by a constricted pit. Seven (7) similar pits, of which one is median and situated in the anterior extremity of the prominence, are distributed in front, at a certain distance from the anterior edge. From each of these paired pits a groove extends backward, the inner one joining the anterior part of the median prominence, the two middle ones on the sides and the two outer ones limiting the median prominence laterally and joining the transverse groove, behind which they pass, and behind which they are recurved. Another transverse groove behind at a little distance from the posterior margin. On the *ventral surface* a transverse groove with the concavity behind, situated immediately in front of the anus, known as the pre-anal groove, which unites with the sub-coxal groove. Behind the pre-anal groove, six longitudinal grooves, especially apparent in the large individuals, symmetrical, three on each side, the middle ones longer, curved inward, and meeting the anus in front by a short median groove which joins their anterior by two branches like an inverted Y. Coxal folds not very prominent; sub-coxal folds well marked, the folds and grooves which limit them stopping at the pre-anal groove. *Stigmatic plates* at the sides and above the coxal folds, opposite the third inter-coxal space, just anterior of the lateral constriction, semi-lunate in outline. Anus wider than long. Four oculiform points (eyes), two on each side, situated on the sub-coxal fold, opposite the first pair of coxae, the second opposite the second inter-coxal space and consisting of a hemispherical shining organ. *Integument* thick, with granulations consisting of irregularly hemispherical prominences, very thin on the summits, thick on the outer parts; plaited and crenulated about their bases; between them, in the narrow depressions, wrinkles or small polygonal meshes. In the large depressions or grooves, on the dorsal surface and on the ventral surface, the granulations are replaced by small oval pits, each one divided into a larger number of small polygonal and contiguous areas. *Rostrum* strong, base short and rectangular, wider than long, sides slightly convex, more or less sunken in a deep pit, with slightly raised edges; mandibles elongate, inner apophysis of digit in the form of a simple claw, inserted a little below the middle; outer apophysis bidentate, with the basal tooth placed opposite the inner apophysis, the upper tooth recurved, with a short point; sheath a little spinous in its anterior part, simply striated the remainder of its extent; hypostome short, wide at its base, rounded or notched at its extremity; teeth forming three irregular longitudinal series; the outer row stronger; on the inside two or three series of teeth becoming shorter and shorter, beginning only in the middle or posterior quarter of the hypostome and extending backward to the same distance as the preceding, each row comprising only five to eight small teeth, decreasing in size; two hairs at the base of the hypostome; palpi elongate and narrow, articles plainly cylindrical, of a diameter diminishing rapidly from first to fourth. On all the surfaces of each article some stout hairs very unequal in length, with blunt or swollen tips, the last article rounded at its tip, which is naked, without spines. *Legs* strong, the fourth pair one and a half times as long as the first;

coxae contiguous, decreasing in size from the first to the fourth pair, striated on the ventral surface, granular on the dorsal and posterior surfaces, with a transverse granular pad at the distal extremity; the second article wider than long in the first two pairs of legs, longer than wide in the other two pairs; dentate on distal edge, with a distal granular pad; third article wider at the distal extremity; fourth article short in the first three pairs of legs, twice as long in the fourth pair; fifth article provided on its dorsal border, in the first three pairs, with three successive teeth, the two proximal quadrangular, the distal conical; on the fourth pair only two conical teeth; tarsi provided on their dorsal border with three teeth, one basal (on the proximal pseudo-article of the last three pairs of legs), the second close to the first (both quadrangular), the third conical near the distal extremity; swollen or blunt hairs fairly numerous, and a few spines on all the articles except the coxae.

Hosts.—Man, goats, sheep, and other mammals.

Habitat.—Somaliland, Kilimanjaro, Congo, Egypt, South-East Africa, India. It is also said to occur in German South-West Africa. It is usually found in loose soil in the shade of trees and rocks in desert tracts, places chosen by animals for rest.

There has been considerable confusion between this tick, its variety *caecus*, and *O. moubata*. I have seen only specimens of *O. savignyi caecus*, but after a careful study of the published descriptions and illustrations of the other two, I have come to the conclusion that if *moubata* can be considered as separate from *savignyi*, it must be only as a variety of the latter species. The main difference between these two seems to be that *moubata* lacks the eye spots, which are present in *savignyi*, and that the inner apophysis of the mandibles are *bidentate*, while in *savignyi* they are *uni-dentate*. *Moubata* cannot be considered as identical with *savignyi caecus*, although both forms lack eyes, because *caecus* agrees with *savignyi* in having the inner apophysis of the mandibles *uni-dentate*. The form of the last two articles of the legs of these three forms, which is a character considered in other species, seems to differ in no essential detail.

A study of the life history of *moubata* and *caecus* shows that they agree in all but one point. Dutton and Todd (1905) state that the larva of *moubata* sheds the egg-shell and moults to the nymphal octopod stage at the same time. Such is not the case with *caecus*. The larva hatches as a true larva with six legs. It crawls about for a short time, but does not feed; then it becomes motionless, the outer skin dries, and, after a time, the octopod nymph emerges.

Taking all these points into consideration, it seems that we must consider these three forms as distinct, but the differences do not seem to me to be of importance enough to consider them as distinct species. My opinion is that both *caecus* and *moubata* are merely varieties of *savignyi*, and should be known as *O. savignyi caecus* and *O. savignyi moubata*.

ORNITHODOROS SAVIGNYI, var. CAECUS, (NEUMANN.)

O. savignyi (Audouin), var. *coecus*, Neumann (1901).

Plate I, figures *a* to *e*; Plate III, figures *g*, *h*.

This variety differs from the type in the following points: The body is generally more swollen; the eyes are absent.

The *females* are 9 to 11.5 mm. long by 6.5 to 8.5 mm. wide; *males*, 8.5 to 9 mm. long by 6.5 to 7 mm. wide. The genital opening of the female is long and narrow, opposite the posterior edge of coxae I, that of the male is short and wide, and opposite coxae II.

Nymph resembles the adult in all respects regarding shape, integument, and grooves. The colour is light yellow when first transformed from the larva; later, deep bluish after feeding; legs translucent; length when first transformed 1 to 1.5 mm., width 0.75 to 1 mm. Genital pore lacking. *Rostrum*, as in adult, projects somewhat beyond anterior edge of body. Mandibles as in male and female; hypostome (*II, f*) in young nymph bears five transverse rows of two teeth each on each half, with numerous crenulations, posterior teeth extending furthest along the outer margin. Stigmata as in adult; anus circular, one large spine on each valve near its anterior end. *Legs* as in adult.

Larva.—When first hatched, nearly circular in outline, sides slightly depressed and parallel, 1 mm. long and half as thick as long; later, it expands slightly, becomes thinner, and, when ready to transform to nymph, is 1 to 1.5 mm. long by 0.75 to 1 mm. wide. Colour light brownish yellow; legs translucent. Integument without papillae, but possessing fine transverse striations; no grooves and no hairs; sexual groove lacking. *Rostrum* projects beyond anterior edge nearly its whole length; mandibles often cannot be made out plainly, but bear same characters as adults; hypostome (*II, e*) small, deeply divided at tip, small denticles at tip, then four rows of teeth, four teeth each to inner rows, but only three teeth in outer rows; two large spines at base. Palpi thick, cylindrical; articles all short and thick, a few stout spines near distal portions of articles. No indications of stigmata. Anus always concealed by a mass of white secretions in rectum. *Legs* stout; no tubercles present as in adults. Becomes whitish before moulting time.

Eggs nearly spherical in shape, 0.9 mm. long by 0.8 mm. wide; dark reddish brown in colour; surface smooth and shiny.

Hosts.—Man, fowls, sheep, goats, cattle, and other animals.

Habitat.—Eastern Africa, including German East Africa, Mozambique, Angola, German South-West Africa, Upper Zambesi, Congo, Transvaal, Natal, Cape Colony, Nubia, Abyssinia, Egypt, Southern Basin of Lake Tchad. Besides being found in sand in desert-like places, it is very common in native huts, where it attacks the inhabitants.

This tick was originally given the name of *Tampan* by Livingstone, being the name employed by certain native tribes along the Zambesi. In Sesuto it is known as *Makarulu*. It occurs in the warmer parts of the Transvaal, where it often becomes a serious nuisance at outspans and in native huts, and occasionally in houses of whites. The life history is much like that of *Argas persicus*, i.e.

short feeding spells alternating with long rests of weeks or maybe months. Several molts are passed as nymphs, and when mature the female alternates feeding with egg-laying. The larval stage, however, never feeds, and does not move about much, but enters into a quiescent state soon after hatching, from which it emerges as an eight-legged nymph. This tick probably transmits human tick-fever in the Northern Transvaal and Moçambique in the same way as its relative *O. moubata* of the Congo.

ORNITHODOROS SAVIGNYI, var. PAVIMENTOSUS,
NEUMANN.

O. pavimentosus. Neumann (1904).

Plate III, figures *f*, *g*, *h*.

This variety differs from the type in the following respects: body more swollen, colour of a more ochreous brown, even when fully engorged; legs (*III*, *g*) shorter than in *savignyi*; same number of teeth on the dorsal margin of article V and tarsi (*III*, *f*), but these teeth are stronger, and almost contiguous on legs I, II, and III.

Females are from 14 to 17 mm. long by 11 to 12 mm. wide.

Males.—Similar to females; 6 to 8 mm. long by 4.5 to 7 mm. wide.

Nymphs.—Resemble adults; *rostrum* as in *caecus*.

Larvae resemble those of *caecus*, only larger; length 1.66 mm., width 1.3 mm. The inner apophysis of the mandible is simple, and inserted lower down; the outer apophysis is bidentate; hypostome with four rows of teeth.

Eggs.—Larger than in *caecus*, darker coloured, nearly black, surface shiny; 1.4 mm. long by 1.0 mm. wide.

Hosts.—Man and other animals.

Habitat.—German South-West Africa. It hides in the sand as *O. savignyi* does.

This form was described by Neumann from a single female collected at Bethany, in Great Namaqualand. I have received a large number of specimens from German South-West Africa in all stages of development, and have also been able to work out the earlier stages of the life history. The life history resembles that of *caecus* in main, but it differs from *savignyi* in being somewhat more swollen, and in the characters of articles V and tarsi, but in no essential details. From *moubata* it differs in the characters of the legs, and in possessing eyes, as in the type. From *caecus* it is distinguished by its larger size, more brownish colour, presence of eyes, and the characters of the legs. The early stages of the life history are like those of *caecus* rather than *moubata*, i.e. the larva hatches, then becomes quiescent, and in a short time sheds its skin, and the octopod form emerges.

It does not seem to me that there are sufficient grounds for making this a separate species; it is, however, distinct from the type, and I have made it a variety, i.e. *savignyi pavimentosus*.

ORNITHODOROS TALAJE, var. CAPENSIS, NEUMANN.

O. talaje (Guérin-Ménéville), var. *capensis*. Neumann.

Plate I, figures *r*, *s*; *Plate III*, figures *a* to *e*.

Adult.—*Body* elongate and narrow with lateral borders, straight or almost straight, parallel, contracted at the anterior extremity into a rounded point, almost straight or slightly convex on the posterior border and joined to the lateral borders by rounded angles; dirty yellow when young, brownish to bluish black when replete. *Dorsal surface* (*III*, *a*) margined by a wide raised border (not so prominent when fully engorged), similar to the rest of the integument, and forming on the anterior end a deep median V-shaped fold; the remainder of the dorsal surface excavated or undulating, with usually an anterior elevation, corresponding to the rostrum; on this elevation, four smooth symmetrical depressions, numerous depressions within the marginal border, surrounding this elevation in a circle. In the posterior half a median line of smooth depressions extending from posterior border anteriorly about one-quarter of the length of the body. A short distance from the anterior end of this median line is a single large depression, with two large depressions on each side of it, near the lateral margins; extending posteriorly from the two posterior of these depressions is a line of pits, similar to the median, but curved inward, and close to and following the lateral margin. On the *ventral surface* (*III*, *b*) a pre-anal groove not very deep, almost straight, ceasing at the coxal folds; a post-anal groove composed of a transverse fold, straight, or a little curved anteriorly or posteriorly, very near the posterior border, a large circular depression at each extremity; an anal groove, ceasing at the post-anal groove, its depth occupied by smooth depressions resembling those on the dorsal surface; sub-coxal and coxal folds well marked, the sub-coxal ceasing at the coxal grooves which pass anteriorly between the coxae of the first and the second pair of legs, which they separate; posteriorly they extend behind coxae IV toward the lateral margin. *Stigmata* on the dorsal surface of the sub-coxal folds, the stigmal opening almost longitudinal, semi-lunate. *Anal* ring almost as wide as long, anal opening provided with two or four spines on each valve. Genital pore opposite posterior margin of coxae I; female pore long and narrow, that of male short and wide. No eyes, but two swellings on margin above legs I and II without any eye-like spots. Integument thin, with hemispherical granulations, shining, contiguous, almost equal in size, forming by their uniformity a network of meshes limited by folds, the centres of which bear one to four very short claviform hairs, with wide bases. *Rostrum* elongate lodged in a deep cavity, with lateral borders very well developed in the form of cheeks like an inverted V-shaped hood, which can fall down and protect it; base of rostrum wider than long, with sides convex, and several long hairs near lateral margins; set on a narrow base, the integument of which is finely honeycombed and wrinkled crosswise, this base allows the rostrum to be inclined forward and to be retracted; *mandibles* (*III*, *e*) with digit large and thick, inner apophysis close to the base, as wide as long, provided with three equal teeth pointing backward, outer apophysis tridentate, with posterior tooth stronger, provided at its base with an additional denticle, anterior tooth very small;

hypostome (*III, c, d*) indented at tip, provided on each side with two rows of teeth which occupy only the anterior half of the organ; numerous small teeth at tip, and in the case of the male several small teeth between large teeth and median line, crenulations or small teeth below large teeth; two hairs at its base. *Palpi*, with the first article longer than wide, bordered inside with a narrow flange, finely chagreened on the dorsal surface; the other articles as wide as long, smooth, numerous long pectinate hairs on all the articles, several short spines terminal on the fourth article. *Legs* long and slender; *coxae* sub-triangular, contiguous, covered on their posterior half with granulations similar to those of the rest of the body; the rest of the surface of the coxae presents very fine granulations, which are found on all the extent of the other articles; coxae I with a blunt tooth on the posterior median angle; second article cylindrical, as wide as long in the second and third pairs, longer in the first and fourth; the third, fourth, and fifth articles scarcely wider at the distal extremity; *tarsi* wider at the base than at the free end; no pre-ungual groove marked, except on the first pair; no teeth on article V and tarsi as in *O. savignyi caecus*. Hairs roughened or semi-pinnate on all the articles, more abundant and longer in the tarsi.

Length of female, 5 to 6 mm.; width, 3 to 3.5 mm.

Length of male, 3.5 to 5 mm.; width, 2 to 3 mm.

Hosts.—Penguins, fowls, (experimentally also man).

Habitat.—So far as is known, this variety is found mostly in the nests of penguins on the islands off the western coast of Cape Colony, where it is very abundant. It has also been reported from Tristan de Cunha.

This variety differs from *talaje* by the lesser development of the cheeks which cover the rostrum. In the species they almost completely conceal the mouth parts, but in *capensis* they furnish only an incomplete protection at the sides, and do not reach so far as the posterior edges of the base of the rostrum. The hairs are also more abundant and longer on the movable articles of the legs than is the case with *talaje*.

I have only seen a few preserved specimens of males and females of this variety, and have never been able to secure live specimens for rearing. Lounsbury records that they seem to alternate long periods of rest with short visits to the host for feeding. He also says that a favourite joke among the labourers of the Guano Islands, off the Cape Coast, is to place these ticks in the beds of new-comers.

SUB-FAMILY IXODINAE.

This sub-family is characterised as follows:—

Rostrum terminal; digit of mandibles provided with two apophyses, inner apophysis generally short, terminated by one to four points equal or unequal; the outer apophysis elongate, parallel or straight, divided on its free border into two to four or five successive teeth, which increases in size from anterior to posterior; palpi free, with four articles, the two middle ones of which are excavated on the inner surface, the fourth very short and in the form of a tactile appendage, being lodged in a sub-terminal pit of the third. *Legs* slightly unequal; those of the second pair the shortest, the fourth pair

longest; with six (8) articles, the third and the tarsi presenting a false articulation near the proximal end, except in the tarsi of the first pair, where it is near the distal end; tarsi provided with a cup-like ambulacre, produced from a caruncle, folded more or less fan-like on the ventral surface of the claws. *Integument* coriaceous, extensible, reinforced by a dorsal shield, emarginated to receive the base of the rostrum, often ornamented with designs and bright colour, grooved in front by two longitudinal grooves (cervical grooves), starting from the angles of emargination at base of rostrum. *Stigmatic plates* situated behind the coxae of the fourth pair of legs. *Sexual opening* median transverse, placed more or less in front, between the coxae of the first three pair of legs; from the commissures of that orifice start two grooves (*sexual grooves*), which extend backwards and diverge more or less, terminating at a variable distance from the posterior margin. Sexual dimorphism very marked; the male is ordinarily smaller than the female, more flattened and often of a less regular oval contour; the anterior extremity being much more narrow than the posterior; the dorsal shield covers all the body or leaves uncovered only a marginal band; the posterior border is usually divided into eleven quadrangular festoons, extending between the dorsal extremities of the two stigmatic plates, and often prolonged on to the ventral surface; the ventral surface often presents shields and plates, the number and form of which are variable. The *female* is flat at first, but from the development of the enormous quantity of eggs, can become of a considerable volume by the extension of its integument in the three dimensions; the dorsal shield is limited to the anterior part and preserves its original dimensions during distention of the body; the posterior portion of the abdomen often presents (in the young) eleven festoons. The dorsal surface of the base of the rostrum has two symmetrical pits (porose areas), with very fine punctuations, which are lacking in males, nymphs, and larvae.

This sub-family is divided into three tribes—the *Ixodeae*, *Rhipicephaleae*, and the *Amblyomeae*.

Ixodeae.—Males clothed on all their ventral surface with shields. Anal furrow of both sexes passing around anus in front, and separate from the genital furrows; no eyes. Rostrum elongate. Includes the genus *Ixodes*.

Rhipicephaleae.—Males provided with one pair of anal shields, ordinarily accompanied by accessory shields. Anal furrow of both sexes passing around the anus behind, and usually joining the genital furrows in front. Eyes present. Rostrum sometimes long and sometimes short. Includes the genera *Rhipicephalus*, *Margaropus*, and *Hyalomma*.

Amblyomeae.—Males without anal shields. The anal furrow surrounding the anus behind and usually joining the genital furrows in front. Sometimes with eyes. Rostrum long or short. Includes the genera *Amblyomma*, *Aponomma*, *Neumaniella*, *Rhipicentor*, *Dermacentor*, and *Haemaphysalis*.

The various genera of this sub-family may be separated by the following key:—

Adults.

- A. Males clothed on all their ventral surface with shields; anal furrow of both sexes passing around anus in front, and not joined to the genital furrows ... (*Ixodeae*), *Ixodes*.

AA. Males with small anal plates or without, but ventral surface *not covered* with plates; anal furrow passing behind anus and usually joining genital furrows, or wanting.

B. Males with two anal plates, usually accompanied by an accessory pair, eyes present ... (*Rhipicephaleae*.)

C. Rostrum long; palpi elongate and valvate
Hyalomma.

CC. Rostrum short; palpi short, broad, with an outward projection on the second article.

D. Anal groove present, stigmatic plates comma-shaped in both sexes ... *Rhipicephalus*.

DD. Anal groove absent; stigmatic plates circular or oval ... *Margaropus*.

BB. Males with no ventral plates; eyes sometimes present
(*Amblyommeae*.)

C. Eyes present.

D. Palpi long, valvate; coxae IV not longer in male than coxae I to III; stigmata triangular
Amblyomma.

DD. Palpi short, thick; coxae IV much larger in male than coxae I to III; stigmata comma-shaped, short.

E. Palpi very short and wider than long; coxae IV with two long spines ... *Rhipicentor*.

EE. Palpi longer than wide; coxae IV without long spines ... *Dermacentor*.

CC. Eyes absent.

D. Palpi long; stigmatic plates comma-shaped.

E. Body as long as wide; anal groove present
Aponomma.

EE. Body wider than long; anal groove not present ... *Neumaniella*.

DD. Palpi with a sharp projection outward; stigmatic plates circular or short comma-shaped
Haemaphysalis.

Nymphs.

(Key based on known Transvaal forms.)

A. Anal groove surrounds the anus in front opening posteriorly.
Ixodes.

AA. Anal groove surrounds the anus behind opening in front.

B. Palpi produced into a prominent lateral point.
Haemaphysalis.

BB. Palpi more or less cylindrical.

C. Body circular in outline; as wide as long
Aponomma.

CC. Body longer than wide.

D. Body narrower behind than in front
Margaropus.

DD. Body as wide or wider behind than in front.

E. Shield pentagonal in outline; antero-lateral edges occupying three-quarters of the length of the shield

Rhipicephalus.

EE. Shield cordiform in outline.

F. Eyes hemispherical ... *Hyalomma.*

FF. Eyes flat ... *Amblyomma.*

Larva.

(Key based on known Transvaal forms.)

A. Body much longer than wide; narrowed at both extremities.

Ixodes.

AA. Body as long as wide, or longer than wide, but widely rounded behind.

B. Palpi produced into prominent lateral points.

Haemaphysalis.

BB. Palpi more or less cylindrical.

C. Body as wide as long; circular in outline

Aponomma.

CC. Body longer than wide.

D. Palpi very short and thick ... *Margaropus.*

DD. Palpi elongate.

E. Palpi of medium length; more or less pointed at tips; dorsal shield allows a portion of the body to show along its antero-lateral edge ... *Rhipicephalus.*

EE. Palpi very long; dorsal shield covers all of anterior portion of body.

F. Eyes hemispherical ... *Hyalomma.*

FF. Eyes flat ... *Amblyomma.*

GENUS IXODES, (LATREILLE.)

Acarus (ex. p.), Linnaeus (1758).

Ixodes, Latreille (1795).

Cynorhaestes (ex. p.), Hermann (1804).

Crotonus (ex. p.), Duméril (1822).

Ixodes, (Latreille), (Neumann, 1899).

Eyes absent. Palpi long. Anal groove opened or closed behind, but tangent to the anus by its anterior concavity. No terminal spurs on the tarsi. The *male* with the ventral surface covered with plates, as follows:—One pregenital plate between the sexual opening and the rostrum; two lateral epimeral plates more or less surrounding the stigmata and coxae; a genito-anal plate, of elongate pentagonal shape, between the sexual opening and the anus; an anal plate, triangular, pointed or circular, behind the preceding, the anterior end surrounding the anus, the base formed by the posterior margin of the body; two quadrangular adanal plates, parallel to the anal shield; dorsal shield leaving a margin more or less wide, uncovered on lateral and posterior margin of body; no posterior festoons. Stigmatic plates oval. *Female* with three longitudinal grooves on the posterior part of the dorsal surface; on the ventral surface two long genital grooves, extending from the sexual opening, and diverging caudad; also two small anal grooves united in front of the anus, parallel or diverging behind, rarely converging. Stigmatic plates circular.

The name *Ixodes* has served to describe the greater part of the *Ixodinae* of various countries and hosts. Although Koch gave a restrictive diagnosis, yet the inexperienced authors continued to include the most varied forms in this genus; most of the descriptions were incomplete, insufficient, and their identification usually impossible. Koch himself has added to the confusion by giving the rank of species to forms, which differ only in age, or stage of engorgement, shape or size, secondary points in a question of this sort.

The genus is sub-divided into three sub-genera—*Euixodes*, *Ceratiixodes* and *Eschatocephalus*. These were formerly considered as three distinct genera, but Neumann considers that the characters which distinguished *Ceratiixodes* and *Eschatocephalus* from *Ixodes* were not of sufficient importance to justify this distinction, therefore he included them in the genus *Ixodes*.

The three sub-genera are characterised as follow:—

Euixodes. Palpi long, valvate; no eyes, anal groove may be open or closed behind; in the male one pregenital, one genito-anal, two epimeral, one anal, and two adanal plates; stigmatic plates oval in male, circular in females.

Ceratiixodes. Palpi long, convex inside, and with a conical prolongation in the male, and swollen at the end in the female. No eyes. Anal groove absent in female, but present in male. One anal and two adanal shields in the male; stigmatic plates circular in both sexes.

Eschatocephalus. Palpi long, claviform, and flat in the female, piriform and not valvate in the male; anal groove contouring anus in front and open behind. Stigmatic plates circular in both sexes. Irregular chitinous thickenings both above and below in the male. Stigmatic plates circular in both sexes.

So far only three forms of *Ixodes* are known in South Africa. *Ixodes pilosus* occurs in the Cape Colony and Orange River Colony, while its variety, *Ixodes pilosus howardi*, is found in the Transvaal and Natal. *Ixodes rubicundus* is reported and described by Neumann from specimens taken in Cape Colony.

Males.

A. Anal shield horseshoe shaped.

B. Male large, 3.15 mm. long by 1.6 mm. wide; teeth on hypostome in one marginal row, other rows represented by crenulations *pilosus*.

BB. Male small, 2.3 mm. long by 1.2 mm. wide; teeth on hypostome in three or four rows ... *pilosus howardi*.

AA. Anal shield rectangular; sides parallel, longer than wide.
rubicundus.

Females.

- A. Anal grooves converging behind the anus, but not joining.
 B. Dorsal shield as wide as long; anal groove with branches not so close together at posterior end ... *pilosus*.
 BB. Dorsal shield longer than wide; anal groove with branches closer together at posterior end *pilosus howardi*.
 AA. Anal grooves parallel behind the anus... *rubicundus*.

IXODES PILOSUS, KOCH.

SHEEP PARALYSIS TICK.

Ixodes pilosus, Koch (1844, 1847).

Ixodes pilosus, Koch (Neumann, 1899).

Male.—*Body* oval; wider and rounded behind; length 3.15 mm.; width 1.6 mm.; colour clear reddish brown. *Shield* convex, covering all the dorsal surface, except a narrow marginal cushion, which is lighter coloured, shining, glabrous; cervical grooves of the normal length, well formed, punctuations very fine, abundant. *Ventral surface* with genital pore wide, opposite coxae III; pregenital shield trapezoidal; anal shield small, longer than wide, sides curved and converging like a horseshoe; anus with three hairs on each valve. On all the surface of the body many hairs, those on the ventral surface short and translucent, those on the epimeral shields reinforced at the base. *Rostrum* elongate; base twice as wide as long, in shape of a trapezoid opening in front on the dorsal surface, a little longer than wide on the ventral surface, where it is pentagonal in outline; mandibles with inner apophysis of digit applied to the dorsal surface in the anterior, where it has the appearance of being doubled; three teeth, the terminal small, the median one strong, and the basilar one weak, the outer apophysis with seven or eight teeth, the anterior ones progressively decreasing, and forming a crest, the posterior ones very strong; hypostome with a marginal series of six to eight teeth on each side, increasing in size from top to base; the remainder of the teeth are reduced to single transverse crenulations; palpi compressed from top to bottom, dorsal face flat, ventral face excavated, hairs scattered over the dorsal surface, in series on the inner margin. *Legs* slender; coxae elongate, coxae I with a strong spine on the postero-median edge; hairs on all the articles of the legs; tarsi slender, forming in leg I about a quarter of the length of the leg.

Female.—When unengorged, *body* flat, oval in outline, much wider and rounder behind; colour yellowish red; long whitish hairs on all the surfaces; when engorged resembles a castor-oil bean, slightly flattened, and becomes of a dark bluish black colour. *Shield* yellowish brown, lighter than the abdomen when young, glabrous, oval, somewhat pentagonal in outline, as wide or almost as wide as long; posterior lateral margins almost straight; cervical groove pronounced, reaching the posterior margin; lateral grooves well marked, and reaching the posterior margin; punctuations very fine, equal on all the surface; a few short, whitish hairs; integument with a few fine

white hairs. *Dorsal surface* with two short anterior grooves, a little divergent; three posterior grooves, the median one straight, and the lateral grooves concave inward; sexual orifice opposite the last intercoxal space; sexual grooves curved and converging at their posterior extremities; ano-marginal grooves curved inward, and approaching at their posterior ends, enclosing a horseshoe-shaped area; anus as in male; stigmatic plates whitish in young specimens, brownish later. *Rostrum* elongate; base reniform on dorsal surface, a little wider than long on the ventral surface, pentagonal in outline; porose areas elongate; mandibles elongate, inner apophysis with two backward projecting teeth, one terminal, the other in the middle of the length, a long point of insertion, ending near the posterior quarter of the digit; outer apophysis with five teeth, progressively increasing from tip to base; hypostome elongate, lanceolate, a series of small teeth at the tip, followed by three rows, more or less regular, of well developed teeth, one lateral row, with teeth strong and sharp, the anterior and posterior teeth weaker, a middle row with smaller teeth, and an inner row of still shorter teeth, not passing below the anterior half of the organ; palpi elongate, narrow, flattened and excavated as in male, article II especially elongate and narrow, constricted at the base. *Legs* slender, coxae elongate, contiguous when young, separated when female is engorged, coxae I, with a rudimentary spine on its posterior margin; hairs on all the articles; tarsi as in male.

Hosts.—On warm-blooded animals, such as ox, mule, horse, cat, dog, pig, leopard, bushbuck, man, sheep, and goat. Dönitz also reports a female as taken from a civet cat at Umtali.

Habitat.—Cape Colony, Orange River Colony, all South African Colonies, in grass districts (Lounsbury).

Lounsbury states that this tick is found in the grass districts of all the South African Colonies, but is never very common. It seems to prefer humid conditions, such as are furnished by ill-drained flats and ravines. It is difficult to rear. All stages seem to prefer the head and ears of the host animal, although they may be found on any part of the body. So far we have not found it in the Transvaal, its place being taken by the variety *howardi*; it is this tick which is supposed to cause the paralysis of sheep in Cape Colony.

IXODES PILOSUS, var. HOWARDI, NEUMANN.

Plate IV, figures a to k.

Male.—Similar to the type species except in the following points: a little smaller than *pilosus*, being 2.3 mm. long by 1.2 mm. wide, instead of 3.15 mm. by 1.6 mm.; the spine on coxae I is very weak; the hypostome (*IV, f*) has three to four rows of teeth on each half, instead of one row and crenulations; the teeth are arranged as follows: denticles at tip, then on each half one or two rows of three teeth each, the lower one of which may be reduced to only one very strong tooth; the inner apophysis of the mandibles has two equal teeth, with a basilar point of insertion (*IV, i*); the outer apophysis has five or six teeth instead of seven or eight.

Female differs from the type species as follows:—*Dorsal shield* (IV, a, c) longer than wide, 1.27 mm. long by 1.1 mm. wide, oval; cervical and lateral grooves less marked; punctuations finer, not so deep, more numerous. Hairs not so numerous on the dorsal and ventral surfaces (IV, a, b); anal groove with branches closer, and forming an ellipse open behind. *Rostrum* (IV, c) not so strong, 0.7 mm. long (instead of 0.85 mm. as in *pilosus*); porose areas smaller, not so deep, more widely separated. *Legs* much weaker, especially the coxae. Colour generally orange red when young.

Larva (unengorged).—*Body* oval in outline, longer than wide, widest behind coxae III; narrowed at both extremities; length 0.5 mm. (including rostrum), width 0.3 mm. *Shield* wide, covers all anterior half of body; broadly rounded behind; no anterior emargination for insertion of rostrum; no cervical or marginal grooves; a few large pits and spines present. *Dorsal surface* with seven grooves; no posterior festoons, but a few very large hairs on the margin. *Ventral surface* with three pairs of large spines in the median area between the coxae; six large spines surrounding the anus, and several spines in the postero-lateral areas; four posterior grooves; anus very far posterior; anal grooves surrounding anus behind; ano-marginal groove present. *Rostrum* with base much wider than long; triangular in outline, with prominent lateral angles; inserted on a long neck, articulated below the dorsal shield; palpi long and slender, article I very small, article II constricted at the base, wide at the distal extremity, twice as long as article III; hypostome very long and slender, with four rows of teeth, nine teeth to a row, the outer rows very large and sharp, the inner rows small and blunt; mandibles as in female. *Legs* very slender; coxae small, rectangular, coxae I with anterior angle prolonged so as to show on the dorsal side beyond the shield; each coxa with two posterior teeth, one on postero-lateral angle, and one on the postero-median angle; tarsi long and slender.

Eggs.—Dark brown in colour; surface smooth and shiny; elliptical in outline; length 0.5 mm., width 0.25 mm.

Hosts.—Dog, cat, hedgehog (*Erinaceus frontalis*), bat (*Rhinolophus* sp.)

Habitat.—Transvaal: Leydsdorp, Moodies (Barberton), Pilandsberg Mountains (Rustenburg District), Lenokana (Marico District), Pienaars River (Pretoria District), Zoutpansberg Mountains (Zoutpansberg District), Piet Retief; Durban.

The principal host of this tick seems to be the dog. Its complete life history has not yet been observed; the adults usually occur more abundantly on the head and shoulders of the dogs. It may prove to be concerned in the transmission of *piroplasmosis* of the dog when this question is fully worked out. In the Transvaal it is confined to low and middle or bushveld, and has never yet been taken on the extreme high grassy veld. As it also occurs at Durban, it will probably also be found all along the eastern coast of South Africa.

IXODES RUBICUNDUS, NEUMANN.

Ixodes rubicundus, Neumann (1904).

Plate IV, figures 1 (a, b).

Male.—*Body*, 2.3 mm. (including rostrum) with an oval contour, narrower in front, 1.2 mm. wide, near the posterior third; chestnut brown. *Shield* convex, shining, glabrous, leaving a marginal cushion exposed, which is wider behind than on the sides, and from which it is separated by a deep groove; cervical grooves straight, superficial, prolonged and diverging near the middle of the length; no posterior festoons; numerous punctuations, small, unequal, regularly distributed. On the ventral surface [IV, 1 (a)] genital pore wide, between the coxae of the third pair of legs; pregenital shield long, triangular; genito-anal shield pentagonal, much longer than wide, with shallow punctuations, not very numerous; anal shield rectangular, with sides parallel, longer than wide, very finely punctured, adanal shields longer than wide, with sides parallel; no hairs; stigmatic plates large, circular. *Rostrum* short; base trapezoidal, larger in front, and wider than long, its posterior angles not salient on the dorsal surface, but so on ventral surface, separated by a similarly salient median pair; mandibles thick, inner apophysis with two strong teeth, the posterior stronger; outer apophysis with three teeth, the anterior small, the posterior very strong; hypostome [IV, 1 (b)] wide, teeth fused on each half into four transverse crenulations with three or four denticles, followed by a row of four or five teeth, and on each side with a very strong tooth; palpi short, the second and third articles almost of same length. *Legs* of medium length, brick red; coxae I with inner spine almost obsolete; the other coxae unarmed; tarsi of medium length, progressively attenuated.

Female.—*Body* in an elongate oval, may reach 10 mm. in length (rostrum not included) by 6.5 mm. wide at the posterior third, brick red on specimens of a small size, but chestnut coloured on others. *Shield* in a short oval, scarcely longer (1.6 mm.) than wide (1.4 mm.), with lateral edges a little convex and diverging from front to rear, then a right angle converging to form the posterior angle, which is rather narrow, anterior margin a little emarginate for the insertion of the rostrum; cervical grooves well marked; almost reaching the lateral margins; lateral grooves very pronounced; punctuations numerous, fine, slightly unequal, few in the lateral areas; surface shiny, glabrous, chestnut brown. *Dorsal surface* with scattered hairs; punctuations very superficial; three posterior grooves. *Ventral surface* with punctuations and hairs similar; genital pore opposite coxae IV, anus very anterior; anal grooves long, parallel, united in front of the anus; stigmatic plates small, circular, whitish. *Rostrum* 0.85 mm. long; dorsal base rectangular, much wider than long; porose areas oval, oblique, converging in front, situated near the lateral margin and separated by an interval equal to their width; on the ventral surface a retrograde spine behind the insertion of each palpus; mandibles with inner apophysis elongate, parallel to the shaft; outer apophysis with five teeth increasing in size from tip to base; hypostome elongate, narrow sublanceolate, with three rows of teeth on each side, the median one short, and with six to seven teeth, the middle one almost as long as the external one, which extends from the tip to the base,

and has fifteen to sixteen teeth; palpi long, rather slender, second article longer than the third. *Legs* slender, brick red; coxae I, II, and III flat, unarmed, with posterior margin sharp; coxae IV more swollen, with a small tubercle on the external third of the posterior margin; tarsi elongate, slender.

Habitat.—Cape Colony.

Hosts.—Sheep.

I have seen no specimens of this tick. The description is taken from that of Professor Neumann. It is supposed to transmit a disease of sheep (Neumann).

GENUS HYALOMMA, KOCH.

Acarus (ex. p.), Linnaeus (1758).

Ixodes (ex. p.), Latreille (1796).

Cynorhaestes (ex. p.), Hermann (1804).

Hyalomma, Koch (1844).

Hyalomma, Koch (Neumann, 1899).

Eyes present, sometimes hemispherical, shining, in a sub-marginal pit of the shield, sometimes flat and scarcely salient. Rostrum long, with palpi valvate. Anal groove in a semi-circle, opening in front, joining the sexual grooves, and followed by a median ano-marginal groove. Body in an elongate oval. Colour brown, more or less intense. *Male* with ventral face provided with two pairs of plates; two anal plates, triangular, large, and two accessory plates, very small, narrow; often two accessory plates behind the anal plates; stigmatic plates comma-shaped with a long tail. Dorsal shield festooned on its posterior margin. Tarsi spurred. *Female* with stigmatic plates triangular; posterior margin of body festooned before repletion.

Koch made the distinction between this genus and *Amblyomma* depend on the eyes, hemispherical in *Hyalomma* and flat in *Amblyomma*. Neumann found that there were a great many intermediate stages between these two types of eyes, but that the presence of anal plates in the male of *Hyalomma* was an essential character. The females of *Hyalomma*, so far as known, he found distinct from *Amblyomma* by their orbited eyes and oval shields, instead of triangular or cordiform shields; also the eyes near the middle of shield instead of near the anterior third or fourth, as in *Amblyomma*. This genus has only a few species, two of which occur in South Africa, *H. aegyptium* with its variety *impressum* and *H. hippopotamense*.

The variety *impressum* seems to be more abundant than *H. aegyptium* in the Transvaal.

Males.

A. Dorsal shield shagreened *aegyptium impressum*.

AA. Dorsal shield with punctuations unequal but distinct.

B. Eyes prominent, black, spherical; punctuations of shield numerous, unequal, coxae I deeply divided

aegyptium..

BB. Eyes small, whitish; punctuations of shield unequal, few in number; coxae I conical ... *hippopotamense*.

Females.

A. Punctuations of shield coarse, unequal.

B. Eyes prominent, hemispherical, black; punctuations numerous but distinct; coxae I deeply divided

aegyptium.

BB. Eyes small, whitish; punctuations large, not very abundant, unequal; coxae I conical ... *hippopotamense*.

AA. Punctuations of shield fine ... *aegyptium impressum*.

HYALOMMA AEGYPTIUM. (LINNAEUS.)

THE BONT LEG TICK.

Acarus aegyptius, Linnaeus (1758).

Acarus hispanus, Fabricius (1794).

Cynorhaestes aegyptius, Hermann (1804).

Ixodes camelinus, Fischer de Waldheim (1823).

Ixodes fabricii, Audouin (1827).

Ixodes savignyi, Gervais (1844).

Hyalomma dromedarii (male and female), Koch (1844 and 1847).

„ *grossum* (female), Koch (1844, 1847).

„ *anatolicum* (female), Koch (1844, 1847).

„ *lusitanicum* (male and female), Koch (1844, 1847).

„ *aegyptium*, Koch (1844, 1847).

„ *fabricii*, Koch (1844, 1847).

„ *rufipes* (male and female), Koch (1844, 1847).

„ *truncatum* (male), Koch (1844, 1847).

„ *hispanum* (male and female), Koch (1844, 1847).

„ *impressum* (male and female), Koch (1844, 1847).

„ *syriacum* (male), Koch (1844, 1847).

„ *excavatum* (male), Koch (1844, 1847).

„ *marginatum* (male), Koch (1844, 1847).

Ixodes grasilentus (nymph), Lucas (1845).

Ixodes hispanus (female), Kolenati (1857).

Ixodes corniger (male), Kolenati (1857).

Ixodes africanus, Megnin (1876).

Hyalomma dentatum, Canestrini et Fanzago (1877, 1878).

Hyalomma corniger, Murray (1879).

Hyalomma hispanicum, Murray (1879).

Ophiodes gracilentus, Murray (1879).

Ixodes algeriensis, Mégnin (1880).

Hyalomma utriculus, Berlese (1889).

Hyalomma algeriense, Canestrini (1890).

Hyalomma aegyptium, (Linnaeus) (Neumann, 1899).

Plate V, figures *e*, *f*, *n*.

Male.—*Body* flat; oval; widest opposite coxae IV; caudal extremity truncate, length 3.5 to 4 mm. (rostrum not included), width 2.25 to 3 mm. *Shield* (*V*, *f*) deep chestnut brown; covering all the dorsal surface, except a narrow marginal border on fully engorged specimens, which is yellowish white; prolonged in a point on each

side beyond coxae I, and extending up to the middle of the length of the base of the rostrum; cervical grooves deep, converging at first, then diverging, becoming wide and shallow; lateral grooves beginning just behind the eyes, and widening as they proceed caudad; eyes black, hemispherical, shining, in a sub-marginal pit near the anterior quarter; punctuations numerous, unequal, scattered over all the surface, large and abundant near margins; a few very short hairs, sometimes three posterior grooves, the median longer, eleven posterior marginal festoons; the median inclined to be triangular; two dorsal porose areas, one on each side and close to the median line, near middle of length of shield, dark coloured and difficult to see. *Ventral surface* yellowish white or brownish; numerous short hairs; sexual orifice opposite first inter-coxal space; anus near posterior third, opposite stigmatic plates; anal plates of a deep brown, more or less elongate, narrow, outer margin reaching almost to level of anterior margin of stigmatic plates, inner margins longer than posterior, and slightly concave, posterior margin truncate; punctuations few, large, a few stout whitish hairs; outside of each anal plate and separated from it by the coxal groove, is a very narrow elongate, accessory plate, chitinous only in its caudal third; opposite and behind each anal plate is a conicle prominence, chitinous, dark brown, sometimes passing beyond the posterior margin; stigmatic plates in the form of a very elongate comma, the posterior extremity of which nearly reaches and sometimes passes beyond the level of the extremity of the accessory anal plates; ano-marginal groove well marked. *Rostrum* elongate; base much wider than long; posterior angles scarcely salient; lateral edges convex; a few large punctuations on dorsal surface, sometimes in a transverse line; mandibles with inner apophysis narrow at base, with tip slightly recurved, transverse process a little below anterior extremity bearing two teeth, the lower slightly larger than the upper; outer apophysis with two teeth, lower one stronger, hypostome spatulate, rounded at tip with numerous denticles, then three rows of ten to twelve teeth on each half, sharply pointed, outer row longer, below these the teeth are squamiform in three rows extending almost to the base; palpi elongate, narrow, valvate; article I with dorsal face a half shorter than ventral face, which is prolonged on the inner edge in a longitudinal apophysis, longer than the article, inner edge bears long hairs directed inward and forward; article II a little shorter than article III on the ventral surface, prolonged on its dorsal surface into an obtuse, flat point, fitting over article I, long hairs on the inner margin of articles II and III; article III as long as wide; article IV very small, a mere hairy papilla in a ventral pit of article III. *Legs* long and stout, pair IV passing beyond the posterior end of abdomen by the last two articles or less; articles III, IV, and V reddish brown, ringed with whitish on distal halves; tarsi I unarmed, a false terminal article in form of a truncate cone, widened behind false articulation; those of other legs with parallel sides, gradually attenuated on their dorsal margins, two short, stout spines; tarsi IV at least four times as long as wide; caruncle short, reaching scarcely half the length of the claws; coxae large, almost contiguous, dark brown, coxae I divided into two long teeth, the inner shorter and wider, a tuberosity near the postero-external angle of coxae II and III; one on each posterior angle of coxae IV.

Female (unengorged).—*Body* flat, oval, widest opposite coxae IV, truncate on posterior margin; deep chestnut brown in colour; 4.5 mm. long (rostrum not included), 3 to 3.5 mm. wide. *Shield* oval, almost hexagonal, glabrous, as wide or a little wider (2.5 mm.) than long, the posterior margin convex, the postero-lateral margins concave, antero-lateral margin convex; cervical grooves deep, narrow, and converging at first, then wide, superficial and diverging behind; marginal grooves lacking; represented by a raised margin; eyes black, hemispherical, shining, near the lateral angles in deep, sub-marginal pits; cervical emargination shallow; punctuations very unequal. *Dorsal surface* (l', c) with three longitudinal grooves, the lateral divided into two unequal branches at the margin close to the edge, eleven caudal festoons; large transverse folds and pits between the dorsal grooves; short whitish hair on all the surface, two dorsal porose areas, one on each side and close to the median line, just caudad of the shield, small and dark coloured. *Ventral surface* with similar hairs and a few medium-sized punctuations; sexual pore narrow, opposite coxae II; anus near posterior third; ano-marginal groove present; a short groove on each side of it; stigmatic plates large, dark chestnut coloured, triangular, almost as wide as long, angles rounded, postero-lateral angle projecting laterally. *Rostrum* similar to that of male except that it is slightly longer (1.5 mm.), and possesses the porose areas, which are elongate, elliptical, and not very deep; the mandibles differ from those of the male as follows: inner apophysis slightly recurved and sharp at the tip, not far from the extremity is borne a transverse process with three sharp teeth; the outer apophysis has a wide base, and bears three teeth, the anterior of which is very small, the other two are large and strong; hypostome and palpi like those of the male. *Legs* like those of the male; coxae like those of the male except that they are not contiguous.

When fully *engorged* the female may attain a size of 20 mm. long by 18 mm. wide, and almost as thick as wide, sides almost parallel, glabrous, or almost so. Colour chestnut brown, lighter than that of shield, sometimes whitish before complete engorgement, often the marginal groove appearing as a whitish line. Hairs and grooves disappear when fully engorged, previous to that stage the anterior grooves appear on the dorsal surface and diverge behind.

Nymph.—*Body* short, oval, more or less swollen, of a colour varying from yellowish white to chestnut brown, 2 to 4 mm. long. *Shield* similar to that of female. *Stigmatic plates* small, nearly circular.

Hosts.—All domestic animals, including horse, mule, ass, sheep, antelope, deer, dog, cat, man, dromedary, camel, ox (the last three by preference), and the following wild animals: giraffe, reed buck, and wild boar. They prefer the regions of the genitals.

Distribution.—Algeria, Tunis, Morocco, Tripoli, Teneriffe, Egypt, Abyssinia, Asia Minor, Persia, Afghanistan, Turkestan, China, India, Mongolia, Senegal, German East Africa, Moçambique, Somaliland, Natal, Cape Colony, Orange River Colony, Transvaal, Walfish Bay, Greece, Crete, Sicily, Sardinia, Italy, Southern France, Spain, Portugal.

This species does not seem to be abundant in the Transvaal, its numbers being far surpassed by one of its varieties, *impressum*. I have never been able to obtain an engorged female so as to be able to rear the various stages of the life-cycle. A comparison of the few specimens which I have collected, however, reveals the following variations from the description as given by Neumann. The male is much smaller than Neumann states, and the outline of the body is altered by the posterior end being cut off almost square, or truncate. The shield is never lighter in the middle, and the median festoon was never found to be white. The cervical projections of the shield are much shorter than indicated in Neumann's figure, as is also the length of the rostrum. But the greatest difficulty exists in the punctuations of the shield. Instead of the punctures being evenly distributed over all the shield, those in a triangular, sunken area, whose base is the caudal margin, are confluent, rendering this area shagreened. The female varies only in one respect, i.e. the lateral of the three grooves in the dorsal surface of the body in the unengorged specimen does not branch into two unequal arms, but remains single.

This species is so variable that it was originally described under a large number of names, as shown by the long list of synonyms. Neumann was the first to study the various types carefully and bring them together under one name. He, however, noted three frequent variations from the type, and described them as varieties of the species.

HYALOMMA AEGYPTIUM, var. IMPRESSUM. NEUMANN.

H. aegyptium (Linn.), var. *impressum*, Neumann (1901).

Plate V, figures *a* to *d*, *g* to *m*, *o*, *p*.

Male.—Differs from the type species in the following characters: *Dorsal surface* widely rounded behind and not truncate; larger than the type, length 4.3 to 5 mm. (without rostrum), width 3.0 mm. to 3.5 mm. *Shield* (*V*, *a*) convex; punctuations equal, small and so abundant as to render the surface shagreened, instead of unequal punctuations and a posterior triangular shagreened area; cervical grooves longer, but posterior grooves, marginal grooves, and caudal festoons almost obliterated; shagreening more marked towards the edges; median festoon rectangular, elongate; lateral tail of stigmatic plates narrower and longer (*V*, *o*).

Female.—Differs from specific type as follows: (Unengorged) larger than type, 6 mm. long by 4 mm. wide. *Body* (*V*, *c*, *d*) elliptical in outline, widely rounded behind and not truncate as in type; shield larger, 2.75 mm. long, and nearly as wide; punctuations equal, fine, very abundant, making the shield shagreened; cervical emargination deeper; cervical and lateral grooves not so strongly marked. *Dorsal surface* (*V*, *c*) in unengorged female more thickly and deeply punctured.

Nymph.—(Only this variety has, with us, laid eggs and development followed in confinement.) *Body* (unengorged) broadly

oval; length (with rostrum) 1.5 mm., width 0.9 mm.; colour, bluish grey. *Shield*, covering anterior half of body, wider than long; antero-lateral margins convex, postero-lateral margins concave; posterior angle broadly rounded; cervical emargination shallow; cervical grooves widely separated, very distinct, first convex, then straight to postero-lateral edges; surface divided into polygonal areas by shallow grooves—no punctuations; eyes very large, hemispherical, dark coloured, shining, in orbits at lateral angles; colour light yellowish brown, varying in depth of colour and sometimes with darker spots. *Dorsal surface* (*V, i*) with short whitish hairs; three grooves, median straight, lateral concave, facing inward, all extending from shield to caudal margin; laterals join cervical grooves of shield. *Ventral surface* (*V, k*) same colour as dorsal, and hairs same; stigmatic plates large, almost circular, and whitish in colour. *Rostrum* light yellowish, base wider than long, pointed sharply at lateral edges so as to appear broadly triangular; palpi elongate; article II more than twice as long as article III; mandibles like those of the female; hypostome spatulate, two rows of teeth on each half, teeth large, strong and sharp. *Legs* stout, pale, yellowish in colour, with numerous long whitish hairs; coxae rectangular; coxae, each bearing two blunt teeth on their posterior margin, those on coxae I sharp.

(Engorged) *Colour* from light yellowish to dark bluish, paler about shield and on margins. *Body* elliptical, sides parallel, length 4.5 to 6 mm., width 3 to 4 mm. *Shield* becomes a uniform chestnut brown. Integument of dorsal and ventral surfaces, with numerous irregular-shaped papillae, larger near the posterior end where they are often confluent. Coxal grooves begin opposite coxae II, approach each other anterior of anus, and then sharply diverge. Ano-marginal groove present. On dorsal surface two anterior diverging grooves, three posterior grooves, median longest, laterals concave near caudal end.

Larva (unengorged).—*Body* elongate, oval, widely rounded behind; length .75 mm., width .5 mm.; colour light yellowish, with internal organs showing through, giving it sometimes a greyish appearance. *Shield* covers anterior half of body; light reddish brown in colour, wider than long, broadly rounded at angles; cervical emargination shallow; cervical grooves well marked, extending to near posterior margin; eyes large, hemispherical, light coloured, shining in orbits at lateral angles, surrounded by a spot of very dark colour; fine punctures evenly distributed over the surface; a large spine at each angle of cervical emargination. *Dorsal surface* (*V, g*) with five shallow grooves, one median; nine caudal festoons, well marked. *Rostrum* light coloured, base sharply pointed on lateral edges, triangular in outline on dorsal surface; palpi elongate, article II twice as long as article III; hypostome spatulate, two rows of eleven or twelve stout pointed teeth on each half; mandibles like those of the female. *Ventral surface* (*V, h*) like dorsal; a pair of long spines in median area, opposite coxae I, another opposite second inter-coxal space, and a third opposite coxae III; four pairs of stigmatic openings, between coxae I and II, II and III, behind coxae III, and one pair near caudal margin. *Legs* slender, tarsi swollen, but tapering rapidly to a point; coxae large; sharp spine on posterior

margin of coxae I, a smaller one on coxae II, and one almost obsolete on coxae III. (Engorged) *Body* broadly oval, slightly longer than broad; colour dark bluish grey, except a round shield at anterior end, which is dirty yellow; no grooves on either surface. *Shield* becomes entirely of a reddish brown colour. Length 1.5 mm., width 1.3 mm.

Eggs.—Very small, light brownish in colour, elliptical in outline, surface smooth, 0.5 mm. long by 0.3 mm. wide.

Hosts.—The hosts are much the same as for the type. Adults attack nearly all warm-blooded animals, and are common on ox, sheep, goat, horse, dog, hare, and even ostriches, fowls and man; it prefers the feet and under parts of such animals. The larvae and nymphs feed on the heads of fowls, birds, hares, rabbits, and have frequently been taken from the ostrich.

Distribution.—This variety seems to be very common throughout the greater part of South Africa, usually in greater numbers than the type. I have received it from Cape Colony, Natal, and the Transvaal, and Neumann reports it from Senegal.

This tick is found even in the driest parts of South Africa, and unfed adults may be frequently found moving about the ground or hidden under bark of trees at outspans. It is one of the ticks with two hosts; the larvae and nymph requiring only one host; the newly transformed nymph settles down next to the old larval skin without dropping from the host. The whole life-cycle probably occupies a year.

HYALOMMA HIPPOPOTAMENSE, (DENNY.)

THE HIPPOPOTAMUS TICK.

Ixodes hippopotamensis (male), Denny (1843).

Ixodes bimaculatus (female), Denny (1843).

Amblyomma hippopotami, Koch (1844, 1847).

Amblyomma hippopotamense (Denny), (Neumann 1899).

Hyalomma hippopotamense (Denny), (Neumann 1906).

Plate IV, figure m.

Male.—*Body* in a short oval, widely rounded behind, 5.8 mm. long by 5.3 mm. wide. *Dorsal shield* shining, convex, with punctuations unequal, rare, a few large and deep; no marginal groove nor posterior festoons; cervical grooves deep in front, prolonged behind to the limits of a pseudo-shield like that of the female; general colour of the shield clear, ochre yellow, or dirty yellowish white with linear designs and punctuations deep brown; the designs consist of a line which cuts off a space like a female shield and expands to the level of the eyes; two lines follow the cervical grooves and delimit a violin-shaped space; behind the limit of this pseudo-shield a fine transverse line, ending in two oblique spots; from the margin extend short, radiating lines, three of which join at each side to a longitudinal, discontinued line; those of the posterior margin represent the limits of the absent festoons; the median is prolonged to the transverse line, which is crossed at the level of the stigmatic plates by a transverse band; eyes small, whitish, hemispherical. *Ventral surface* (IV, m);

anal plates large, wide, triangular, almost twice as long as wide, inner margin concave, outer and posterior convex; the colour is deep chestnut; a few large bristling hairs on the posterior part; stigmatic plates comma-shaped, chestnut coloured, lighter on the periphery, and surrounded by an outer concave margin; a small supplementary ivory-like plate. Base of *rostrum* reddish brown, lateral margins whitish; palpi yellowish white on their dorsal surface. *Legs* of medium length; articles whitish on their dorsal margin and at the distal extremity; coxae I conical, with point thick, recurved backward and a little outward; near the postero-external angle a narrow long spine.

Female.—*Body* oval, flat, 8 to 8.5 mm. long. *Dorsal shield* cordiform of same colour as that of male, with design similar to that of male; punctuations large, more abundant than in male; inside the eyes a small oblique spot; eyes as in the male. *Dorsal surface* deep reddish brown, traversed by longitudinal grooves, punctured, wrinkled; a marginal groove and posterior festoons near the posterior third, inside the marginal groove, and, on each side, a large light-red spot, rounded, salient, smooth; abundant hairs on the remainder of the dorsal surface. Stigmatic plates as in male. *Rostrum* and *legs* as in male.

Hosts.—*Hippopotamus amphibius*.

Habitat.—South Africa, East Africa.

I have never seen a specimen of this species, and the above description is compiled from those given by Neumann in his "Révision de la Famille des Ixodidés."

GENUS MARGAROPUS. KARSCH.

Margaropus, Karsch (1879).

Boophilus, Curtice (1890).

Rhipicephalus, Neumann (1897).

Margaropus, Karsch (Neumann, 1907).

Rostrum short; palpi, more or less angular; eyes present. No anal groove. Stigmatic plates circular or oval; two anal plates, free or united in part, with or without accessory plates in the male. A strong terminal spur on the tarsi.

There are only two species, with several varieties, in this genus, *M. annulatus* and *M. lounsburyi*. It was a study of the latter species which he made in 1907 that caused Neumann to re-erect this genus. A study of both sexes of *M. lounsburyi* made him conclude that it was closely related to *R. annulatus*, which had always been causing so much difference of opinion as to whether it should stand in a separate genus, or form a sub-genus of *Rhipicephalus*. The females were so closely similar that they plainly could not be separated, while in the males the absence of anal grooves and the circular form of the stigmatic plates clearly sets them off from *Rhipicephalus*, although they do not resemble each other in other details, such as in the form of the anal plates. The new species made him decide that they should

be placed together in a separate genus. The name *Margaropus* was given to the genus because this name had been given by Karsch to a form from Chili prior to the proposing of the generic term *Boophilus* by Curtice in 1890. As it happened, the form which Karsch named (*M. wenthemii*) was a monstrosity, of one of the varieties of *R. annulatus*; the legs of the male individual were very flat and dilated as in the male of *lounsburyi*; but according to article 27, of International Rules of Zoological Nomenclature, *Margaropus* has the priority over *Boophilus*, since it refers to the part of the species named first.*

Males.

- A. Four anal plates, free in front of anus; legs sub-cylindrical.
- B. Hypostome with six rows of teeth; anal plates pointed at posterior tips; caudal appendage blunt, but always present *annulatus decoloratus*.
- BB. Hypostome with eight rows of teeth; anal plates square cut at posterior ends; caudal appendage small and conical, often absent *annulatus australis*.
- AA. Two anal plates, united in front of the anus; articles of legs very much dilated, articular angles deep... *lounsburyi*.

Females.

- A. Articles of legs sub-cylindrical; spur short, ambulacre sub-terminal.
- B. Hypostome with six rows of teeth; mandibles with lesser process bicuspid *annulatus decoloratus*.
- BB. Hypostome with eight rows of teeth; mandibles with lesser process tricuspid, centre of shield usually yellowish *annulatus australis*.
- AA. Articles of legs dilated at distal extremities; spur very long, ambulacre inserted at dorsal border of spur, remote from the tip *lounsburyi*.

Nymphs.

- A. Shield as wide as long *lounsburyi*.
- AA. Shield longer than wide *decoloratus* and probably *australis*.

Larvae.

- A. Coxae I bicuspid, three pairs of stigmatic openings *australis*.
- AA. Coxae I without teeth, four pairs of stigmatic openings. *decoloratus*.

*In "Bericht über den XIV Internationalen Kongress für Hygiene und Demographie," II, p. 179, appears a paper by Dönitz in which he treats of the ticks transmitting Texas fever or redwater. He claims that the specimen upon which Karsch founded his genus *Margaropus* was not a monstrosity, as claimed by Neumann, but is in every way identical with the species *M. lounsburyi*, Neumann. If this is the case, we must then retain the genus *Boophilus*, our blue ticks becoming *Boophilus annulatus decoloratus* and *Boophilus annulatus australis*, while *M. lounsburyi* becomes only a synonym of *Margaropus wenthemii*, Karsch. The question now arises as to how this *M. wenthemii* came into South Africa from South America. Undoubtedly it was brought out some years ago on Argentine horses.

MARGAROPUS ANNULATUS, var. DECOLORATUS,
(KOCH).

THE BLUE TICK.

Rhipicephalus decoloratus, Koch (1844, 1847).

Rhipicephalus decoloratus, Koch (Neumann, 1897).

Rhipicephalus annulatus, (Curtice), var. *decoloratus*, (Koch)
(Neumann 1901, 1904).

Margaropus annulatus, (Curtice), var. *decoloratus*, (Koch) (Neumann 1907).

Plate VI, figures *a* to *o*.

Male.—*Body* oval, narrowed in front, presenting its greatest width (1.0 to 1.5 mm.) at the level of the stigmatic plates, length 2.0 to 2.75 mm.; integument very thin, often allowing the ramifications of the intestines to show through. *Shield* (VI, *a*) reddish brown, covering all over the dorsal surface, prolonged on each side of the rostrum in front by two horns, the inner of which is smaller; two cervical grooves, shallow and wide, extending to the posterior margin, interrupted in the middle and widened into a shallow pit at its resumption; a median groove in the posterior half, posterior festoons scarcely marked, except the median ones, which are indicated by scallops; punctuations large, superficial; numerous short hairs scattered all over the shield, which is finely wrinkled; eyes pale, very small, often almost invisible, at level of first inter-coxal space; dorsal porose areas at posterior third of length, very small and well separated. *Ventral surface* (VI, *b*) same colour as dorsal, with numerous long, whitish hairs on all its extent; sexual orifice wide, situated a little behind the level of the anterior margins of coxae II, a large triangular plate forms its posterior margin; anus near posterior quarter of length; on each side of the anus an elongate plate, extending forward as far as the posterior margin or middle of coxae IV, anterior end pointed, inner margin longer and prolonged into a conical point on posterior end; posterior margin emarginate; outside of each anal plate another much smaller and narrower, but of almost same shape as first; both of these pairs of plates may extend beyond the posterior margin of the body; a strong conical caudal prolongation of the body on the median line; truncate on the tip and curved downward; stigmatic plates almost circular, large. *Rostrum* (VI, *c*) very short, dorsal base hexagonal, wider than long; lateral angles very sharp, inserted into a rather shallow emargination of the shield; ventral base semi-circular; mandibles (VI, *f*), with inner apophysis of digit, bearing a transverse process with two sharp teeth; outer apophysis with two teeth, the lower large and strong, the upper very small and sub-terminal; hypostome short and wide, emarginate at tip, numerous denticles on anterior end followed by three rows of large teeth on each half; palpi short, sub-conical, with articles as wide as long; article I concealed in part under anterior dorsal margin of base of rostrum; article II constricted at base, widened in middle into a prominent crest on both inner and outer margin; numerous strong spines, especially on inner margin; article

III swollen, sub-triangular on dorsal surface, transverse crest present on ventral surface; article IV small, sub-conical, in a pit on antero-ventral part of article III. *Legs* strong; coxae large, contiguous, as wide as long; coxae I prolonged anteriorly into a long point which extends beyond the cervical angle of the shield and is visible from above; posterior margin divided into two short, stout teeth, sometimes not very prominent; coxae II and III, with the two posterior teeth, barely indicated; tarsi terminated by a strong recurved spine preceded by a smaller one on the ventral margin of coxae II, III, and IV; caruncle almost half as long as the claws; stiff hairs on all the articles.

Female.—*Body* elliptical, as wide in front as behind, generally a little constricted in the middle near the level of coxae IV; length 10 mm. by 6 mm. wide; when unengorged, length 2 mm. by 1.1 mm. wide; colour, when unengorged, bluish or yellowish, with darker bands and lines, shield capitulum and legs light reddish brown, shield lighter in posterior part between cervical grooves; when engorged of a deep bluish colour (brownish in alcohol), with yellowish lines marking the ramifications of the intestines. *Shield* (VI, *d*) very small, longer than wide, emargination in front to receive the rostrum, very shallow; lateral edges straight and parallel, then curved and converging from the level of the eyes, posterior angle widely rounded; cervical grooves diverging, dividing the shield into three unequal parts, the middle portion widest and flat, the lateral portions arched; eyes small, near the anterior third; punctuations small and few; hairs numerous and long, mostly in cervical angles of the shield. *Dorsal surface*, with three antero-posterior grooves, interrupted near the middle, stopping a little distance from the shield and posterior margin, all of these nearly effaced in extreme engorgement; a few short hairs present on all the surface, each in a deep pit when unengorged. *Ventral surface* same colour as dorsal, and with hairs same; sexual orifice small, very anterior, narrow, opposite coxae I; sexual grooves commencing at level of coxae II, slightly divergent, and extending to near posterior margin; stigmatic plates a very short oval, nearly circular; anus near posterior third; no anal groove; ano-marginal groove long. *Rostrum* (VI, *d*) like that of the male in form, larger, base a little wider, more salient in front of shield into which it does not fit so deeply; mandibles (VI, *e*) with transverse process of inner apophysis, bicuspid, outer apophysis with three teeth, two lower teeth large and strong, anterior small and sub-terminal; hypostome as in male; palpi as in male, except that they are longer. *Legs* rather short and slender, first pair shortest, yellowish brown in colour; coxae longer than wide, coxae I sub-triangular, posterior margin divided into two teeth, more or less well developed; coxae II, III, and IV with posterior teeth barely indicated; tarsi as in male.

Nymph.—*Body* elongate, oval, very narrow behind and wide in front; length 1.3 mm. by 0.9 mm. wide when unengorged, when engorged 2 mm. long by 1.3 mm. wide. Colour light, yellowish or greyish with dark streaks and lines, as in unengorged female. *Shield* legs and capitulum light reddish brown, with a red spot lateral of the cervical grooves on the shield; lateral areas of shield darker coloured. *Shield* longer than wide, lateral angles near the

middle of the length, cervical emargination shallow, cervical grooves superficial and diverging, postero-lateral margins straight, posterior angle truncate; a few hairs and pits present. *Dorsal surface* (VI, *m*) with three longitudinal grooves, the median longest; a few long whitish hairs on the surface, each in a deep pit; constrictions opposite each of the coxae. *Ventral surface* like the dorsal; anus a little posterior of the middle of the length; three long spines on each valve, two posterior and one anterior; no anal groove; ano-marginal groove long, genital grooves deep and only slightly divergent, reach almost to the posterior margin; stigmatic plates large and almost circular; no caudal festoon. *Rostrum* short, base wide and narrow on dorsal surface, with sharp lateral projections; ventral surface nearly semi-circular; hypostome narrower than in adult, with three rows of teeth on each half; mandibles (VI, *g*) as in male; palpi short, cylindrical, with numerous stout hairs. *Legs* short and thick; coxae rectangular, except coxae I, which are triangular; no teeth on coxae; tarsi short and thick, no spurs present.

Larva.—*Body* oval (when unengorged), a little narrowed in front, broadly rounded behind; length 0.3 mm., width 0.3 mm.; when engorged 1.1 mm. to 1.3 mm. long, by 0.9 mm. wide; colour yellowish, with shield darker. *Dorsal shield* thin, covering more than half of the dorsal surface, almost as wide as long; widely rounded behind; cervical emargination shallow; cervical grooves short and deep. Both *dorsal and ventral surfaces* (VI, *n, o*) with numerous fine short whitish hairs; *anus* large, near posterior quarter; one large spine on posterior part of each valve; stigmatic openings in four pairs, one behind each pair of coxae, and a posterior pair further back; a pair of large spines on the median ventral area opposite I and II intercoxal intervals and opposite coxae III caudal festoons present. *Rostrum* as wide as long, base an elongate rectangle on dorsal surface, semi-circular on ventral surface; mandibles as in female; hypostome narrow, spatulate, with two rows of six or more teeth on each half; palpi with articles cylindrical, without lateral projections, provided with long hairs; article IV relatively large, inserted obliquely within and behind on article III. *Legs* relatively strong; coxae large and triangular, no teeth present; tarsi short and thick, terminating in curves, without spurs; caruncle one-third the length of the claws.

Hosts.—Cattle, mules, horses, donkeys, sheep, goats, and dogs, although cattle are its chief hosts.

Distribution.—In South Africa generally, Cape Colony, Orange River Colony, Transvaal, Natal, Rhodesia, German South-West Africa, Madagascar, Mauritius, Congo, Uganda, German East Africa, Mozambique, Cape Verde Islands.

This is one of our commonest ticks in South Africa, and is found nearly everywhere. There are two or three generations in each year. It is the transmitter of redwater of cattle, or Texas fever as it is known in America, where the type *M. annulatus* transmits this disease. In South America and Australia the same disease is transmitted by other varieties of the same species of tick.

MARGAROPUS ANNULATUS, var. AUSTRALIS, (FULLER).

Rhipicephalus australis, Fuller (1899).

Rhipicephalus annulatus, (Curtice), var. *australis*, (Fuller), (Neumann, 1901, 1904).

Margaropus annulatus, (Curtice), var. *australis*, (Fuller), (Neumann, 1907).

Plate VI, figures *p* to *s*.

Male (VI, *p*, *q*) differs from *decoloratus* as follows:—A little smaller, more regularly oval in outline, less contracted in front; hairs much more abundant. No indications of caudal festoons; caudal prolongation small and conical, sometimes wanting; hypostome with eight rows of teeth; mandibles with transverse process of inner apophysis tricuspid (VI, *r*); spines of coxae I more deeply separated; articles of legs relatively more slender; oval stigmatic plates not pointed on caudal extremity.

Female differs from *decoloratus* as follows:—Slightly smaller when engorged, tending to a globose form and not elongate; dorsal shield a third smaller and relatively wider, usually yellowish in the middle; eyes not so apparent. *Rostrum* very short; mandibles as in male; hypostome with eight rows of teeth.

Hosts.—Same as *decoloratus*, cattle, horses, deer, buffalo, etc.

Distribution.—Australia, Borneo, Sumatra, Singapore, and southern districts of Cape Colony.

Lounsbury mentions this tick as occurring in the south-east districts of the Cape Colony, very commonly on cattle. There was some doubt in my mind as to whether it was really *australis* or not, until I received some specimens from Kingwilliamstown, C.C., along with *decoloratus*. They certainly conform to the characters given for *australis*. This variety also transmits redwater of cattle. *M. annulatus* is an American species, and was first described in 1821 by Say as *Ixodes annulatus*. Since then there has been a difference of opinion by various workers as to whether this species should belong to the genus *Rhipicephalus*, or form a separate genus by itself. In 1891 Curtice proposed to form a genus *Boophilus* for its reception. This was adopted by most American authors, but when Neumann prepared his "Révision de la Famille des Ixodidés" (1907), he placed it in genus *Rhipicephalus*, considering that the characters were not distinctive enough to form a separate genus. He, however, gave it the rank of a sub-genus, so that *Rhipicephalus* was composed of the sub-genera *Eurhipicephalus* and *Boophilus*. In 1906, however, he received some specimens of a tick from South Africa, the characters of the males of which were very peculiar, but the females of which were so similar in all essential characters to those of *R. annulatus* that he came to the conclusion that these two species were worthy of being raised to a separate genus, and called it *Margaropus*.

In various parts of the world there are ticks closely resembling *annulatus*, so much in fact that they are distinguished with difficulty and were once thought to be identical with *annulatus*. In each case these ticks transmit Texas fever, or redwater.

Fuller made a careful study of these varieties, using the following characters for comparison :—

1. Furrows on dorsal shield of female.
2. Number of rows of teeth on the hypostome.
3. Form of the mandibles, especially inner apophysis
4. Extent of dorsal shield of male.
5. Presence or absence of tail in male.

The following tables show the relationship of the South African varieties and the type as worked out by Fuller :—

- I. Furrows of dorsal shield of the female extending to the posterior lateral margin—*annulatus*, and vars. *decoloratus* and *australis*.
- II. Hypostome with eight rows of teeth—*annulatus* and var. *australis*.
Hypostome with six rows of teeth—var. *decoloratus*.
- III. Mandibles with inner apophysis tricuspid—*annulatus*.
Mandibles with projections as well—var. *decoloratus*.
Mandibles with inner apophysis tricuspid and presenting a rounded projection—var. *australis*.
- IV. Male with shield extending to the posterior margin—*annulatus*, var. *decoloratus*, and var. *australis*.
- V. Male with an indication of a tail—*annulatus*.

Male with distinct, horny tail—var. *decoloratus* and var. *australis*.

Based upon these studies Fuller thought himself justified in re-establishing Koch's *decoloratus*, and in making the Australian type a distinct species.

Neumann, after a careful study of a very large quantity of material, came to the conclusion that the above distinctions were insufficient from a specific point of view, and decided to make them only varieties of the original species *annulatus*. He found that the hypostome in the male bore quite constantly eight rows of teeth, but in the female this number varied more ; even in the varieties supposed to bear six or ten rows of teeth, he found them frequently with a tendency to eight rows ; even in the type itself there is a tendency to division. The conditions of the inner apophysis of the mandible he found to vary considerably with the condition of the preparation studied, and therefore he thought that the tricuspid appearance was due to some tendon at the base, looking like a third tooth. He also found the caudal prolongation in the male of *australis* sometimes almost disappearing.

I, myself, have been unable to find eight rows of teeth in *decoloratus* or the third row dividing.

MARGAROPUS LOUNSBURYI, NEUMANN.

LOUNSBURY'S TICK.

Margaropus lounsburyi, Neumann (1907).

Plate VII, figures a to e.

Male.—*Body* flat, oval, with sides convex, wider near the middle of the length, terminated behind by a conical prolongation, longer than wide, and wider than thick ; total length (from the anterior extremity of the

rostrum to the caudal extremity of the prolongation) 3.9 mm. to 4.3 mm. ; width 1.9 mm. to 2.3 mm. *Shield* (VII, *b*) a little convex, narrow, dark brown, brilliant, not covering all the dorsal surface, leaving free a narrow margin on each side, which is finely striated, and is prolonged behind the regularly rounded border of the shield, by the caudal appendix ; in front a deep emargination to receive the contraction of the rostrum ; a few very short hairs behind the surface corresponding to a female shield ; punctuations very rare, small, unequal ; cervical grooves superficial, reaching almost to the anterior third of the length of the shield ; no marginal groove and no posterior festoons ; three posterior longitudinal grooves, the median one a little shorter than the other two, which extend almost half the length of the shield ; eyes very small, depressed, scarcely visible, marginal, behind the emergence of legs I ; marginal border clothed, especially in the posterior half, with long hairs joined by six to ten into transverse bands ; caudal appendage bearing on each side, at its base, a hemispherical projection, and clothed with a bunch of long hairs, behind and on each side a loose dorsal bunch of hairs, which join a ventral and longitudinal band of hairs, the two ventral bands unite in front of another sub-caudal appendage, which is chitinous, blackish, blunt and twice as long as wide. *Ventral surface* (VII, *a*) reddish brown, almost flat, with punctuations shallow, scattered, clothed with short hairs. Genital pore covered with a retrograde valve, situated opposite the first inter-coxal space ; anus at the anterior summit of a deep, median fossa, limited on each side, by an adanal shield, in the form of a sharp spine, long, chitinous, free in its whole extent ; the two spines unite on the median line at the anterior edge of the anus, forming thus a fork with two teeth, which is prolonged in front by an irregular, smooth plate to the level of the last inter-coxal space ; stigmatic plates short, oval, edges brownish, stigmatic orifice nearly central, the whitish background is formed of numerous granulations hemispherical and shining. *Rostrum* (VII, *c*), with dorsal base, wider than long, without lateral projections, wider in front than behind, the posterior angles indicated by two small conical projections ; mandibles (VII, *d*) with inner apophysis conical, sub-terminal, transverse, with base large, tip bifid ; outer apophysis with two teeth, the terminal one small ; hypostome wide, a little longer than the palpi with eight rows of six to seven teeth, preceded by a surface covered with very numerous and very small denticles ; palpi very short, thick, the first article only visible on the ventral surface, in the form of a transverse band, the second at least as wide as long, rounded on the exterior, wider on the dorsal face, narrower at its base, provided with hairs on its external dorsal edge ; the third almost twice as wide as long, forming exteriorly toward the middle of its exterior border a short point ; the fourth small, short, cylindro-conical, sub-terminal. *Legs* strong, thick, increasing from the first to the fourth. coxae contiguous, sub-triangular ; coxae I, II, and III provided with a very small spine near the internal angle of coxae I ; tarsi sub-conical, similar, increasing a little from I to IV, a false articulation, distal in I, proximal in II, III, and IV ; a strong terminal spur, long, preceded by a spine on the ventral side, and bearing at its base, on the dorsal border, an ambulacre with a disc as long as the spur, and terminated by two weak claws ; all the articles very chitinous, dark brown on their distal and ventral border ; with the fourth pair the second article is sub-cylindrical, the third strongly dilated exteriorly, is thus rendered rectangular, wider than long, flattened

from one side to the other, and its false articulation proximal, and indicated by a small disc of insertion; the fourth dilated the same, irregularly hexagonal; the fifth, less dilated, seems inserted on the preceding by the middle of the ventral border. This disposition produces on the dorsal border of the three legs deep sinuses, which correspond in the second, third, and fourth articulations; the third pair shows a similar dilation, but less pronounced in the same articles; the third and the fourth sub-rectangular, but a little longer than wide; the fifth approaches the ordinary form, and the articular sinuses are shallower than in the third pair; this is true in the first and second pairs, but more feebly developed.

Female.—*Body* elliptical or oval (a little wider in front than behind), generally a little constricted in the middle (at the level of the stigmatic plates), often attaining 16 mm. in length by 10 mm. in width; of a yellowish grey tint (young) or deep brick red (engorged and in alcohol). *Dorsal shield* glabrous, very small, longer than wide (about 1.10 mm. by 0.92 mm.), emargination in front, for insertion of base of rostrum, lateral edges parallel, and a little convex at first, then curved, and converging from the region of the eyes to unite in a broad rounded angle; cervical grooves well marked, dividing the shield into three parts, the median at least twice as wide as the lateral; eyes relatively large, projecting, of the same colour as the shield toward the middle of its length, punctuations absent; colour reddish brown. For almost the whole of the length of the *dorsal surface* two longitudinal grooves, less marked in front, disappearing a little distance from the shield, and from the posterior border; between them, an uneven groove occupying more of the posterior half of the length of the body. On the *ventral surface*, genital pore small, very anterior, opposite coxae I; genital grooves commencing only at the level of coxae II; stigmatic plates in a short oval, with wide axis longitudinal, hairs very short, scattered over the surface of the body. *Rostrum* (VII, e) very short, the base more than twice as wide as long, sub-hexagonal, inserted in the shield by its posterior half, with sides convex, not angular; posterior angles not salient; porose areas elongated transversely; twice as wide as long, separated by an interval less than their length; mandibles resembling those of the male; hypostome resembling that of the male, but with eight to nine teeth in a row, with anterior denticles few in number; palpi similar to those of the male, longer, the third article less angular on the exterior. *Legs* very different to those of the male, and conforming to those of *annulatus*, but thicker, with articles deep brown at their distal extremities; coxae sub-triangular, rounded at the internal tip; a very small spine toward the middle of the posterior border of coxae I; articles II and III swollen at their distal extremities; tarsi long, terminated by a long spine, and relatively slender; preceded by a small spine on the ventral side, and bearing at its base on the dorsal side an ambulacre, with a disc resembling that of the male.

Nymph.—*Body* 2 to 2.5 mm. long; greyish; cordiform (wide in front, narrow behind); *shield* as wide as long, pentagonal. *Legs* cylindrical, with the articles short and swollen at the distal extremity; tarsi short.

Hosts.—Horses, and sometimes cattle.

Habitat.—The highland districts of Cape Colony, Basutoland, and probably Orange River Colony, Central Africa.

This tick is spoken of by Lounsbury in 1905 as *Rhipicephalus* (B) *sp.*. He says it occurs in Cape Colony in the high inland districts, most probably because more horses are found there, and not on account of the climate. I have had it sent in also from Basutoland. It is found principally upon horses, and cattle are seldom infested, even when horses are very scarce. Horses often become very badly covered with these ticks when they run over the veld in the winter time. Very few are found during the summer months. From adults to hatching of larvae, in Capetown, took 186 to 201 days, and is probably longer on the veld. Lounsbury says that development cannot be forced in an incubator. There is probably only one generation in a year.

GENUS RHIPICEPHALUS. KOCH.

Acarus (ex. p.), Linnaeus (1758).

Ixodes (ex. p.), Latreille (1795).

Rhipicephalus, Koch (1844).

Phaulixodes Berlese (1889).

Boophilus, Curtice (1890).

Rhipicephalus, Koch, (Neumann, 1897).

Eyes present. Base of rostrum wider than long, hexagonal on the dorsal surface, forming on each side a prominent lateral angle. Palpi short, wide, the third article prolonged on the ventral by a short retrograde point; the first article by a lobe on the inner side, sometimes not very prominent, and slightly retrograde. Coxae I ordinarily with two strong teeth. Stigmatic plates comma-shaped, with a short tail in the female, and a long one in the male; males provided usually with two pairs of ventral plates, in the region of the anus and known as (1) anal plates, next to the anus, and (2) accessory anal plates, smaller in size and situated laterally of the anal plates. Males usually with a caudal prolongation on the posterior margin of the body.

This is one of the most important groups of ticks because of the role which so many of its species play in the transmission of diseases. It is especially an African genus, fully three-quarters of the species referred to it being found in Africa.

It presents the most difficulties to the student of the *Ixodidae*. Many of the species seem almost impossible to separate, especially where one has a large series of specimens with all stages of variations. The immature stages are very similar, and even the most careful study may fail to distinguish the species to which they belong.

The females are more difficult to distinguish than the males. The only characters which are easy to use are those of the shield and base of rostrum. With the males the characters of the shield, base of rostrum, and anal plates are of most use.

The males differ from the males of other genera by the fact that the body is much more slender, and after feeding a few days it usually swells.

and projects slightly beyond the shield on the lateral and posterior margins, the caudal prolongation also usually appearing at this time.

I have been unable to obtain or rear the immature stages of each species, so that the study of these stages is incomplete.

The following discussion, together with the keys, may serve to make the distinctions between the species more apparent. The drawings in the plates are made from what seemed typical specimens, and will probably assist most in studying this difficult genus.

MALES OF RHIPICEPHALUS. (See *Plates VIII and IX.*)

Among the males, *evertsi* is probably the most readily recognised, because of its shagreened shield and also its saffron-coloured legs. Besides this the eyes are spherical and in orbits (*VIII, a*).

R. oculatus resembles it closely in the matter of the eyes, but although the punctuations on the shield are numerous, fine, and almost equal, they do not coalesce so as to give a shagreened appearance (*VIII, b*).

In *capensis* the shield is shagreened, but here the eyes are not spherical, but flattened on the lateral margins (*VIII, c*).

R. sanguineus is the type species of the genus. The punctuating of the dorsal shield is here very distinct; the punctures are unequal in size, the smaller ones, more numerous, do not coalesce, but are regularly distributed; the larger punctuations are fewer in number and are arranged in more or less regular fashion. There is a narrow posterior groove, with a large, oval, shallow pit on each side of it, with further forward two wider, smooth impressions; the caudal prolongation is very short or may be wanting (*VIII, e*). Another species known as *punctatissimus* was originally described by Gerstäcker, and differed from *sanguineus* in the punctures being distributed more irregularly on the shield. Later studies made by Dönitz seem to show that this species is synonymous with *sanguineus* or at most only a variety of the latter species.

R. appendiculatus.—This species, together with *bursa*, have caused considerable confusion; *appendiculatus* is easily recognisable by the elongate, slender caudal prolongation, but where this is not present the punctuation is typical (*VIII, d*). The large punctuations are mostly confined to the anterior end of the shield, but in a large area on each side at about the middle of the length of the shield the punctuations are very scarce and very superficial. There is not so much difference in the size between the large and small punctuations as is the case with *sanguineus* and other species of *Rhipicephalus*. The anal plates are also characteristic, both ends are pointed quite sharply, and the accessory anal plates are only indicated or lacking.

R. bursa might be easily confused with *appendiculatus*, were it not for the anal plates, which are very broad, and not narrow and slender as in *appendiculatus*, there are also very small and slender accessory plates present. The punctuations of the dorsal shield are more even in size and distributed evenly over all its extent, a few large punctuations do exist, but they are situated near the margins and anterior end (*VIII, h*). The punctuations bring it near to *capensis*, which is, however, shagreened.

R. simus is quickly recognised. It is larger than *appendiculatus*, and the shield is almost black in colour and polished so as to shine

brightly. The grooves on the shield are almost obsolete, and the fine punctuations are very fine and superficial and few in number. The large punctuations are very large and distributed in four irregular longitudinal rows. These rows may vary in continuity, and the relative number and size of punctuations, both large and small, may vary considerably. The anal plates are triangular, with posterior edge rounded and inner edge concave (VIII, f).

R. nitens is considered by some workers as only a variety of *appendiculatus*. The punctuations on the dorsal shield are numerous, the small ones are very fine and superficial, but the large ones are confined to the margins and irregularly distributed in the anterior region. The anal plates are semi-lunate in shape and pointed at both ends.

R. lunulatus lies between *sanguineus* and *simus*. The males are smaller than *simus*, but almost equal to *sanguineus*. The small punctuations of the shield are larger than in either of these species, more numerous and evenly distributed over the whole surface. The large punctuations are most numerous in the anterior position, but four irregular lines extend longitudinally over the shield. The anal plates are triangular and concave on the posterior margin, forming two sharp teeth on posterior angles (VIII, g).

R. duttoni is very similar to *R. appendiculatus* and *R. lunulatus*. It differs from the former, however, in the body not projecting beyond the lateral margins of the dorsal shield; the fine punctuations are more evenly distributed over the surface of the shield, and larger than the fine punctuation of *appendiculatus*; the posterior angles of the base of the rostrum are more prominent than in *appendiculatus*. The anal plates are not spindle shaped, as in *appendiculatus*, but broadly triangular, with the inner angle of the base very prolonged and sharp. In *lunulatus* the two basilar angles are of about equal length and the plates are not so wide.

FEMALES OF RHIPICEPHALUS. (See Plate X.)

The females of this genus are much more difficult to distinguish than the males. The characters most used are the shields, as with the males, and the base of the rostrum.

Based on shape of shields, we may divide the species into two groups, (1) those with shields longer than wide, and (2) those with shields as wide or practically as wide as long. Class one includes *sanguineus*, with the doubtful species *punctatissimus* and *appendiculatus*, although the last one is not always apparently longer than wide. The remaining species come under class two. Dividing the species on the character of the eyes, we find that *evertsi* and *oculatus* have spherical eyes, situated in deep orbits, while the remaining species have flat unorbited eyes. In *evertsi* and *capensis* the punctuations on the shields are so numerous as to produce a shagreened effect, while the remainder of the species have the punctuations distinct and not coalescing.

R. evertsi is easily recognised from its broad oval shield, orbited eyes, and shagreened surface, as well as by its saffron-coloured legs (IX, a).

R. oculatus does not have the heart-shaped shield shagreened, but the eyes are orbited, setting it off at once as distinct from the other species (IX, b). The punctuations are mostly fine and distinct, with a few

very large ones in the median area and near the anterior margins, in this resembling *sanguineus*, but, unlike *sanguineus*, the shield is as wide as long.

R. capensis closely resembles *evertsi*, except that the eyes are flat, marginal grooves well developed, and a few large punctuations in the anterior part (*IX, c*).

R. sanguineus has a shield much longer than wide and very narrowly rounded behind. The eyes are situated near the posterior third of the length. The punctuations are mostly fine, and distant, on the whole surface of the shield. In the median area, the base of the marginal groove, and the marginal areas, are a few irregularly distributed very large punctuations (*IX, e*). The doubtful species *punctatissimus* is probably synonymous with *sanguineus*, as all the characters agree.

In *appendiculatus*, the shield is slightly longer than wide, but not so noticeably so as in *sanguineus*. The eyes are at about the middle of the length of the shield. The fine punctuations are larger than in *sanguineus*, and thickly distributed over all the surface, except in an area on each side near the eyes, where they are fewer in number. The large punctuations are mostly confined to the anterior and lateral portions of the shield. The porose areas on the base of the rostrum are separated by more than their diameter, thus separating them from *sanguineus*, where these porose areas are only about a diameter from each other (*IX, d*).

In *bursa* the dorsal shield is plainly as broad, or broader, than long, and hexagonal in outline. The punctures are equal, fairly fine, and evenly distributed over the whole surface; the porose areas in the rostrum are also separated by more than their diameter.

In *simus* the shield is as wide as long, with the sides rounded; in fact it often appears nearly circular in outline. The colour is nearly black, instead of dark brown, the usual colour, and shiny as in the male. The fine punctuations are numerous, evenly distributed, and usually very fine and superficial, often scarcely visible. The large punctuations are very large and few in number, situated in the median area, at the bottom of the marginal grooves and in the anterior portions of the marginal areas. Both the cervical and marginal grooves are continued to the posterior margin of the shield, where they meet (*IX, f*).

In *nitens* we find a shield similar to that of *appendiculatus*. It is oval in outline, but scarcely longer than wide; the marginal grooves are very superficial. The punctuations are unequal, the small ones numerous and superficial, while the large ones are situated in the median area and near the anterior edges, and not so scattered as in *appendiculatus*. Like *appendiculatus*, the porose areas of the rostrum are separated by more than their diameter.

The females of *lunulatus* resemble those of *simus*, as regards the dorsal shield, which is, however, slightly more elongate, of a brown colour, and with the fine punctuations slightly larger and more prominent. The large punctuations are smaller than in *simus*, and not so numerous. The cervical and marginal grooves are not so long, and do not meet at the posterior margin of the shield (*IX, g*).

Males.

- A. Eyes orbited.
 - B. Shield with punctuations so close as to produce a shagreened effect ; shield deep brown in colour, body and legs saffron yellow *evertsi*.
 - BB. Shield with punctuations distinct ; legs and body not saffron coloured *oculatus*.
- AA. Eyes flat.
 - B. Shield with punctuations numerous.
 - C. Punctuations unequal in size.
 - D. Punctuations all very apparent ; caudal prolongation absent or short.
 - E. Anal plates with posterior edge straight or convex *sanguineus*.
 - EE. Anal plates with posterior edge concave.
 - F. Anal plates with a single inner prolongation *duttoni*.
 - FF. Anal plates with two posterior prolongations *lunulatus*.
 - DD. Punctuations mostly very fine ; large ones in anterior and marginal areas.
 - E. Anal plates triangular, pointed at both ends ; caudal tail twice as long as wide *appendiculatus*.
 - EE. Anal plates semi-lunate in outline .. *nitens*.
 - CC. Punctuations equal or almost equal.
 - D. Punctuations distant but numerous, fine, covering all the shield *bursa*.
 - DD. Punctuations contiguous in places, making the shield shagreened.. .. . *capensis*.
 - BB. Punctuations on shield not very numerous, but large ; usually arranged in fairly regular longitudinal lines ; fine punctuations may be present, but usually invisible .. *simus*.

Females.

- A. Eyes orbited.
 - B. Shield short, oval ; punctuations coalescing so as to make surface shagreened ; legs saffron yellow in colour .. *evertsi*.
 - BB. Shield elongate, oval ; punctuations numerous, but not coalescing ; legs not saffron coloured. *oculatus*.
- AA. Eyes flat.
 - B. Shield oval, longer than wide, punctuations on shield unequal, numerous *sanguineus*.
 - BB. Shield short, oval, or as wide as long.
 - C. Shield shagreened except on the margin .. *capensis*.
 - CC. Shield with punctuations distinct.
 - D. Punctuations equal or nearly so, thick and close, but not coalescing *bursa*.
 - DD. Punctuations unequal in size.

E. Fine punctuations scarcely visible, large punctuations very large and few in number
simus.

EE. Fine punctuations very apparent.

F. Large punctuations scattered
appendiculatus.

FF. Large punctuations near lateral anterior margins and in middle area .. *nitens.*

Nymphs.

A. Eyes hemispherical ; base of rostrum with sides rounded
evertsi.

AA. Eyes flat ; base of rostrum with lateral edge produced into a point.

B. Base of rostrum with lateral angles short ; cervical grooves of shield nearly reaching posterior margin ; marginal grooves present, postero-lateral margin of shield concave
appendiculatus.

BB. Base of rostrum with lateral angles very long and sharp ; palpi very slender and conical at tips ; cervical grooves short ; marginal grooves lacking ; shield quadrangular, with posterior margin convex. *simus.*

Larvae.

A. Eyes hemispherical ; shield covers all of anterior portion of body.
evertsi.

AA. Eyes flat ; shield allows a portion of the body to show along the antero-lateral margin.

B. Base of rostrum with lateral edges rounded ; palpi moderately long *appendiculatus.*

BB. Base of rostrum with lateral edges produced into very long sharp points ; palpi long and slender and sharply pointed at the tip *simus.*

Eggs.

A. Dark brown in colour *evertsi.*

AA. Light brown in colour *appendiculatus, simus.*

RHIPICEPHALUS EVERTSI. NEUMANN.

THE RED TICK.

Rhipicephalus evertsi, Neumann (1897).

Plate VIII, figures *a, i, k* ; *Plate IX*, figure *a* ; *Plate X*, figure *a* ;
Plate XI, *a, e.*

Male.—*Body* short oval, widely rounded behind ; 5 to 6 mm. long by 3 to 4 mm. wide, widest at the level of coxae IV ; colour saffron yellow, except the shield and rostrum, which are dark chestnut brown. *Dorsal shield* (*VIII, a*) does not cover all the dorsal surface, but allows a margin of the body to be exposed on the sides and posterior end ; convex, shining, punctuations numerous and contiguous, or almost so, making the

shield shagreened; cervical grooves concave outward, prolonged to near the middle of the shield; lateral grooves deep, not passing beyond the first festoon, punctuations on the lateral margin not contiguous, but distinct; three longitudinal grooves in the posterior portion; festoons short, with punctuations distinct, continued on the exposed portion of the body; eyes small, reddish brown in colour; spherical in orbits. *Ventral surface* glabrous, with short hairs, reddish yellow in colour; sexual orifice opposite the anterior edge of coxae II; anal plates triangular (*IX, a*), posterior edge rounded, reddish brown in colour, punctuate, with or without short hairs; a very short spine opposite the centre of the eyes; festoons faintly marked, median festoon often prolonged into a short point. Stigmatic plates (*VIII, i*) reddish brown in colour, comma-shaped, with a postero-dorsal prolongation. *Rostrum* reddish brown in colour; base wider than long, bearing punctures near its posterior margin, which is straight; lateral angles projecting sharply near anterior third of length; mandibles (*XI, i*) with process of inner apophysis of digit conical, divided into two teeth on its outer edge; outer apophysis bears two teeth; the lower one stronger; hypostome with six rows of teeth; palpi longer than wide; article I with a fringe of hairs on its medio-ventral margin; article II wider than long with a row of hairs on the corresponding margin; article III wider than long. *Legs* saffron coloured, of medium length; coxae I produced into a point anteriorly, which may be seen from the dorsal surface, posterior margin divided into two large teeth; the other coxae each with two short teeth on their posterior margins. *Tarsi* relatively long, two terminal, consecutive spines, except on tarsi I; the caruncle passing slightly beyond the middle of the claws.

Female.—*Body* oval; deep chestnut brown in colour; often with reddish spots on fully engorged specimens; may reach a length of 14 mm. by a width of 10 mm., and a thickness of 8 mm. *Shield* (*X, a*) short oval in shape; sides slightly sinuous, 1.9 mm. by 1.6 mm. wide; blackish brown in colour, shiny; surface entirely shagreened; cervical grooves extending to the posterior quarter of the shield; no marginal groove; eyes hemispherical, small, shiny, reddish brown in colour, near the middle of the length; in orbits. *Dorsal surface* of abdomen, in young specimen, bears a deep lateral groove, which extends to the antepenultimate festoon; punctuations large, except near the shield, in the bottom of each a very small white hair; four short anterior grooves and three long posterior ones; festoons well marked; when engorged only indications of the longitudinal grooves and the festoons persist. *Ventral surface* smooth with fine punctuations, bearing small whitish hairs; sexual orifice small, opposite first intercoxal space; sexual grooves extend to posterior margin; anus rather anterior. *Rostrum* reddish brown in colour; base wider than long, posterior angles scarcely noticeable; porose areas deep, elongate; mandibles with process of inner apophysis of digit tridentate, middle tooth longest, outer apophysis with three teeth, posterior the strongest; hypostome with six rows of teeth; palpi elongate; article II longer than wide; article III only slightly longer than wide; a fringe of stout hairs on the medio-ventral margin of articles I and II. *Legs* saffron coloured, longer than those of the male; coxae small; coxae I deeply bidentate; coxae II, III, and IV each with two small teeth on their posterior edges; tarsi longer than those of the male, spines of tarsi II, III, and IV not so strong as in the male; caruncles similar to those of male.

Nymph.—*Body* (unengorged) elongate, elliptical; reddish brown in colour; length 1.5 mm. by 1 mm. wide. *Shield* covers anterior half of body. When engorged, body oval, widely rounded, slightly wider in front than behind; length 4.5 mm. by 3 mm. wide; colour bright bluish, lighter on margins. *Shield* pentagonal (*XI a*); longer than wide, well rounded behind; deep brown in colour; lateral angles very posterior; cervical grooves nearly straight, deep, reaching almost to the posterior margin; eyes hemispherical, dark coloured. *Dorsal surface* with numerous unequal, deep and irregularly distributed pits, each with a minute whitish hair; two anterior grooves very divergent and slightly concave outward, sometimes these grooves are doubled by a second groove which is not continuous throughout its extent; three posterior grooves one median and faintly marked, laterals shorter and slightly divergent posteriorly. *Ventral surface* sometimes with whitish hairs; punctured as on dorsal surface; ano-marginal groove distinct and reaching to the posterior margin; genital grooves widely divergent behind coxae IV; stigmatic plates whitish, nearly circular; anus near posterior third of length. *Rostrum* (*XI, a*) short; base much wider than long; posterior edge straight; sides rounded; hypostome with four rows of teeth; mandibles with inner apophysis bearing a tridentate process, outer apophysis with three teeth, the upper of which is very small; palpi elongate, cylindrical, article I very short, article II at least twice as long as broad, article III only slightly longer than broad. *Legs* slender; reddish brown in colour; coxae each bear two blunt, almost inconspicuous teeth on their posterior margins, those of coxae I are longer and sharper than those on the remaining coxae; tarsi elongate, no spurs.

Larva.—*Body*, when unengorged, elongate, elliptical, widest near middle; well rounded behind; length 0.5 mm., width about 0.3 mm.; colour light yellowish; shield darker coloured and covering anterior half of body. When engorged, body is elongate, elliptical, sides nearly parallel; length 1.2 mm. by 0.6 mm. wide; colour deep brownish blue. *Shield* as wide as long; widely rounded behind; colour light reddish brown; shagreened; cervical grooves deep anteriorly then shallow, extending two-thirds of the length of the shield; eyes small, hemispherical, dark coloured. *Dorsal surface* (*XI, e*) with three longitudinal grooves. *Ventral surface* (*XI, e*), with anus near posterior third; eleven festoons, distinctly marked; stigmatic openings in four pairs, one behind each coxa and a fourth pair in the posterior portion of the body, not far from the margin. *Rostrum* short; base wider than long; posterior margin concave; sides rounded; palpi short and thick, article I very short, article II twice as long as wide, article III as wide as long; hypostome with four rows of teeth; mandibles with process of inner apophysis tridentate; outer apophysis tridentate, upper tooth very small and sub-terminal. *Legs* slender; coxae with no teeth; tarsi elongate.

Eggs.—Dark brown in colour; surface shiny; elliptical in outline; length 0.5 mm. by 0.3 mm. in width.

Hosts.—The different domestic animals, ox, horse, ass, mule, sheep, dog, giraffe, eland, reed buck.

Habitat.—South Africa: Cape Colony, Transvaal, Natal, Rhodesia, German East Africa, tropical Africa, German South-West Africa, Moçambique.

This tick has been found to be concerned to some extent in the transmission of East Coast fever; it also transmits billary fever of the horse, mule, and donkey. It is able to withstand very dry and desert conditions, and is found even in the Karroo. Unlike most other ticks, it passes its first molt on the host, and the second off the host; that is, it visits two hosts during its life-cycle instead of three.

RHIPICEPHALUS OCULATUS. NEUMANN.

THE EYED TICK.

Rhipicephalus oculatus, Neumann (1901).

Plate VIII, figure *b*; *Plate IX*, figure *b*; *Plate X*, figure *c*.

Male.—*Body* narrow, regularly widened from front to rear; 3 mm. long (rostrum included). *Shield* (*VIII*, *b*) reddish brown in colour; covers all or the dorsal surface; cervical grooves long, very divergent; lateral grooves deep, commencing at a little distance from the eyes, stopping at the outer festoon; a median posterior groove; festoons short; punctuations numerous, fine, sub-equal, distinct and not coalescing; eyes small, hemispherical, shiny, in an orbit. *Ventral surface* brownish in colour; anal plates elongate (*IX*, *b*) triangular, inner edge longer than outer edge; secondary plates weak, spinniform; no caudal prolongation; stigmatic plates elliptical, dark coloured, very long caudal prolongation, extending in a postero-dorsal direction; sexual opening opposite coxae II. *Rostrum* with base wider than long; lateral angles near the anterior third of the length; the posterior angles prominent; a line of punctuations parallel to the posterior margin; mandibles with process of inner apophysis transverse, bidentate on outer edge, outer apophysis with two teeth, terminal one weak, basilar tooth strong; hypostome with six rows of teeth; palpi short and stout, article I and II prolonged backward on their ventral surfaces, all three articles having a fringe of hairs on their medio-ventral edges. *Legs* slender; coxae I bidentate; coxae II, III, and IV, each with two teeth on their posterior margins; tarsi II, III, and IV terminate by two consecutive spurs.

Female.—*Body* of variable length. *Shield* elongate, oval (*X*, *c*); longer than wide; dark brown in colour; cervical grooves extending to the posterior third of the length; lateral grooves well developed, reaching the posterior margin; punctuations mostly small, sub-equal, occasionally coalescing, a very few larger ones in the median and lateral areas; eyes small, shiny, hemispherical, in orbits, behind the middle of the length of the shield. *Dorsal surface* of body with four anterior grooves and three posterior grooves. *Ventral surface*: stigmatic plates oval, with a posterior dorsal projection; anus near posterior third; sexual opening opposite first intercoxal space; festoons indistinct; *Rostrum* like that of male; outer apophysis of mandibles with three teeth. *Legs* slender as in male.

Hosts.—Cattle, *Lepus sp.* (Damaraland).

Habitat.—Damaraland, Transvaal, German East Africa.

RHIPICEPHALUS CAPENSIS. KOCH.

THE CAPE BROWN TICK.

Rhipicephalus capensis (Koch, 1844, 1847).*Rhipicephalus capensis*, Koch (Neumann, 1897).*Plate VIII*, figure *c*; *Plate IX*, figure *c*; *Plate X*, figure *b*.

Male.—*Body* oval, widely rounded behind, in which part it is three times as wide as in front; length 3 to 5 mm. (including rostrum), width 1.75 to 3.0 mm. *Dorsal shield* (*VIII, c*) a little convex, shining, dark chestnut brown in colour, covered with contiguous punctuations, which give it a shagreened appearance; a few large punctuations in anterior portion; cervical grooves deep anteriorly, extending to the level of the eyes, which are flat, large, and pale yellow; lateral groove wide, deep, close to the margin, extending from the eyes to the separation of the two extreme festoons; lateral margin also shagreened; festoons distinct, shagreened, extreme festoons short, median ones elongate. *Ventral surface* glabrous, yellowish; sexual orifice opposite the middle of coxae II, followed by a whitish, strap-like appendage; sexual grooves parallel; anus opposite the middle of the stigmatic plates; anal plates (*IX, c*) almost isosceles triangles, base rounded, dark brown in colour, slightly punctured; accessory anal plates elongate and narrow, half as long as the anal plates; festoons very plainly marked, each with a transverse spot of dark chestnut colour; stigmatic plates large, whitish, elongate, comma-shaped. *Rostrum* dark brown in colour; base almost as long as wide; shagreened in the middle; angles prominent; palpi longer than wide; article II wider than long; a row of long stout hairs on the ventro-median margins of article II and III. *Legs* dark brown, strong; coxae typical, coxae II, III, and IV, each with two short teeth on their posterior margins; coxae I with two very long sharp teeth; tarsi short, two consecutive spurs, except on tarsi I.

Female.—*Body* elongate, oval; a little wider behind than in front; 5 mm. long by 2.7 mm. wide. *Shield* (*X, b*) almost as wide as long; sides rounded; reaches the middle of the body in unengorged specimens; dark chestnut brown in colour; punctuations confluent making surface shagreened, except on the lateral margins; cervical grooves reach almost to the middle of the shield; marginal grooves reach to the posterior margin; eyes flat, shiny, pale yellow in colour, a little behind the middle of the length of the shield. *Dorsal surface*, dark brown in colour, glabrous, coarsely shagreened by undulating, irregular transverse folds, crossing two short longitudinal grooves and three long posterior grooves; marginal groove well marked, as also the festoons, which are separated by slightly sinuous grooves. *Ventral surface* shagreened like the dorsal surface, and of same colour; festoons plain, elongate. *Rostrum* with base wider than long; posterior angles only slightly projecting; hypostome with six rows of teeth; palpi elongate, article II as wide as long, dorso-median margin longer than the dorso-lateral margin; article III as wide as long; a fringe of stout hairs on the ventro-median margin of articles I and II. *Legs* more slender than in the male; otherwise similar to those of the male.

Hosts.—Cattle, goat, dog, horse, *Varanus saurus*.*Habitat*.—Namaqualand, Cape Colony, Transvaal.

This tick has also been found to be concerned in the transmission of East Coast fever. It is not a very common tick in the Transvaal. In Cape Colony it extends for some distance into the Karroo.

RHIPICEPHALUS SANGUINEUS. (LATREILLE.)

THE EUROPEAN BROWN TICK.

Ixodes sanguineus, Latreille (1804).

Ixode plumbe, Duges (1834).

Ixodes duguessi, Gervais (1844).

Ixodes rufus, Koch (1844).

Rhip. sanguineus, Koch (1844).

Rhip. limbatus, Koch (1844, 1847).

Rhip. siculus, Koch (1844, 1877).

Rhip. rubicundus, Frauenfeld (1867).

Rhip. stigmaticus, Gerstäcker (1873).

Rhip. beccarri, Pavesi (1883).

Phaulixodes rufus, Berlese (1889).

Rhip. sanguineus (Latreille) (Neumann, 1897).

Plate VIII, figure *e*; Plate IX, figure *e*; Plate X, figures *e*, *k*.

Male.—*Body* regularly enlarged from front to rear, 3.35 mm. long by 1.55 mm. wide, often with a conical prolongation on the posterior end. *Shield* (VIII, *e*) reddish brown, covering all the dorsal surface except a narrow margin on the sides and posterior end; cervical grooves short; a short median groove in the posterior part of the shield on each side of which is a rounded pit; punctuations unequal, fine ones numerous on all the surface, large ones very large and more numerous in the anterior portion of the shield; marginal grooves well marked; eleven rectangular, posterior festoons; eyes pale coloured, situated at level of posterior margin of coxae II. *Rostrum* with base wide, lateral angles projecting sharply; palpi short and stout, articles I and II prolonged backward on their ventral surfaces; inner margin of article I projecting inward; articles I, II, and III each with a row of stout dental spines on the inner ventral margins; process of inner apophysis of mandible tridentate, outer apophysis bidentate, terminal tooth weak (*X*, *k*); hypostome with six rows of teeth, with about twelve teeth in a row. *Ventral surface* brownish in colour; on each side of anus is an elongate triangular plate, the tip of which extends to the level of coxae IV, the inner edge longer than the outer edge, base rounded (*IX*, *e*); a small spine outside of each of these plates; stigmatic plates comma-shaped. *Legs* slender, dark brown in colour, coxae I bidentate, coxae II, III, and IV each with two spines on their posterior margins; tarsi II, III, and IV terminated by two strong, consecutive spurs; all the articles with numerous stiff hairs.

Female.—*Body* elliptical, as wide in front as behind, often reaching a size of 11 mm. long by 7 mm. wide; reddish brown or yellowish in colour. *Dorsal shield* (*X*, *e*) very small, longer than wide (about 1.5 mm. long), lozenge oval in outline; truncate in front to receive

the base of the rostrum; punctuations unequal, a few large ones in median area and forming part of lateral grooves, but the greater part fine and distant from each other; eyes in the middle of the length or slightly posterior of middle; cervical grooves elongate, nearly reaching posterior margin; lateral grooves deep and almost meeting cervical grooves at posterior end. *Dorsal surface* glabrous or almost glabrous; in the young female, four anterior grooves, sometimes not well marked, three posterior grooves. *Ventral surface* glabrous; festoons slightly marked; stigmatic plates oval, with a short postero-dorsal prolongation. *Rostrum* with base wider than long, lateral angles large and sharp, giving it a width twice that of the posterior margin; porose areas large, elliptical, close together; palpi not so short and massive as in male, and not so angular on outer edge; the three articles bearing spines as in male; inner ventral margin of article I projecting inward; hypostome with six rows of teeth of about 12 teeth to a row; mandibles (*X, k*) with process of inner apophysis tridentate, but teeth not so pronounced as in male; outer apophysis tridentate, anterior tooth sub-terminal and small. *Legs* rather slender, deep brown in colour; coxae longer than wide, coxae II, III, and IV, with two small spines on posterior margins, as in male, but the outer spine is not so strong as in male; stiff hairs on all the articles; especially on dorsal and ventral margins of articles III to VI; tarsi II, III, and IV with only one ventral spur, proximal spur represented by a blunt tuberosity.

Nymph.—(*Phaulixodes rufus*.) *Body* elliptical, a little compressed, greyish, reddish brown or blackish, often 5 mm. in length. *Dorsal shield* very small, elongate pentagon, lateral margins almost straight, not diverging very much; surface irregularly reticulated; cervical grooves diverging only behind; eyes on lateral angles, near posterior third. *Dorsal surface* of abdomen with four anterior grooves, the outer ones shorter; three posterior grooves, the median straight and the outer ones curving outward. On the *ventral surface*, sexual pit, unperforated, opposite coxae II; sexual grooves well marked; ano-marginal groove long; stigmatic plates circular. *Rostrum* very short, base a little widened behind insertion of palpi. Mandibles almost like those of female; hypostome with two rows of teeth on each half; palpi a little valvate, with a few scattered hairs; articles a little prominent on the outer edges, article IV relatively long. *Legs* short, slender, coxae I with division not very deep; the others as in female; tarsi without spurs.

Hosts.—Especially the dog, but also cattle, sheep, cat, sometimes man, and the following wild animals of South Africa and other countries:—Lion, fox, genet, hare, hedgehog (*Erinaceus niger*), lynx, jackal, gazelle, dromedary, chamoise, tortoise, pangolin, *Olus ellipsiprymnus*, *Canis megalotis* (Egypt), *Strix ascalaphus* (Egypt), *Lepus ethiopicus* (Nubia and Abyssinia), *Vulpes persica* (Arabia).

Habitat.—France, Italy, Sicily, Corsica, Roumania, Egypt, Somaliland, Algeria, Abyssinia, Nubia, Beirut, German East Africa, Portuguese East Africa, Natal, Cape Colony, Transvaal, Madagascar, German South-West Africa, Cameroons, Togo, Congo, Senegal, Antigua, Arabia, Persia, India, Singapore, China, Phillippine Islands, Australia, Panama, French Guiana.

This tick is of very wide distribution over Europe, Africa, and Asia, even extending into Central America. It seems to be of fair occurrence in the Transvaal, but is confined mostly to the northern and eastern

portions. The commonest host in the Transvaal is the dog ; one specimen has been taken from the ringed pigeon, and, what is probably a nymph of *sanguineus*, from the striped mouse (*Avicanthis pumillio*) at Pretoria. Dönitz states that *sanguineus* transmits a disease of dogs in France.

RHIPICEPHALUS LUNULATUS. NEUMANN.

Rhipicephalus lunulatus, Neumann (1907).

Plate VIII, figure *g* ; Plate IX, figure *g* ; Plate X, figure *g*.

Male.—*Body* a little wider behind and acuminate behind ; length 4 mm. (rostrum included), width 1.9 mm. near the posterior third. *Shield* (VIII, *g*) convex, shining, very dark brown, almost black in colour, without spots, showing a slight margin of the abdomen beyond the sides of the shield ; cervical grooves very short ; marginal grooves deep, occupied by large punctuations, commencing immediately behind the eyes and ending at the groove which separates the two extreme festoons ; punctuations large, distant, in irregular lines, one line on each side, a little inside of the marginal groove, forms its prolongation forward ; a few very fine punctuations in front, almost obsolete ; eyes flat, yellowish, large, marginal. *Ventral surface* reddish brown, punctuated with a few very short hairs ; anus near the anterior quarter of the anal plates (IX, *g*) ; the latter elongate, triangular, the inner margin concave, the outer margin convex, the posterior margin divided into two unequal lobes, the outer one of which is spine shaped ; the outer pair of anal plates projecting, spiniform ; no caudal prolongation ; stigmatic plates narrow, elongate comma-shaped, with the point recurved toward the dorsal surface. *Rostrum* 0.55 mm. long, dorsal surface of the base wider than long, lateral angles projecting, situated near the anterior quarter of the length, posterior angles not very prominent ; hypostome slightly spatulate, with six rows of teeth ; mandibles with process of inner apophysis elongate transversely and bidentate, outer apophysis bidentate ; palpi scarcely longer than wide, flat on the dorsal surface, the second article as long as the third and contracted into a point on its posterior-dorsal margin. *Legs* relatively strong. Coxae I with anterior point slightly visible from the dorsal surface, bears two very long spurs ; on the posterior margin of the other coxae, two wide, flat teeth ; tarsi medium in size, with terminal claws.

Female.—*Body* a wide ellipse in outline, length 8 mm. (including rostrum), width 6 mm., widely rounded at both extremities ; dark blue in colour. *Shield* (X, *g*) small ; dark brown in colour ; longer than wide or as wide as long ; widely rounded behind ; cervical grooves deep in anterior part, reaching posterior margin ; lateral grooves deep, set off by large punctuations ; nearly reaching posterior margin, punctuations small, evenly distributed, and well separated from one another, a few very large punctuations in median area, marginal grooves, and marginal ridges. *Rostrum* with base much wider than long ; posterior angles not very prominent ; lateral angles very prominent, porose areas small, circular, and separated by a diameter, numerous punctuations between them ; palpi typical ; hypostome with six rows of teeth ; mandibles with process of inner apophysis tridentate ; outer apophysis with three teeth. *Dorsal surface* glabrous, four anterior grooves and three posterior grooves. *Ventral surface* glabrous, numerous punctures and a few short whitish hairs ; sexual

opening opposite first intercoxal space; stigmatic plates short, comma-shaped; genital grooves extending to posterior margin, ano-marginal groove well marked; festoons not very distinct. *Legs* slender, reddish brown in colour; coxae II, III, and IV, each with two strong teeth on posterior margin; coxae I, bidentate; tarsi with two ventral spurs; hairs on all the articles.

Hosts.—Dog, hedgehog (*Erinaceus frontalis*), horse.

Habitat.—Congo Free State, Transvaal.

This tick has only recently been described (Neumann, 1907) from the Congo. In the Transvaal it has only been taken in the Zoutpansberg district on dogs and hedgehogs.

RHIPICEPHALUS DUTTONI. NEUMANN.

THE CONGO BROWN TICK.

Rhipicephalus duttoni, Neumann (1907).

Male.—*Body* narrow in front, broadest (1.85 mm.) a little posterior to the middle, length with rostrum 3.55 mm. *Dorsal shield* slightly convex, chestnut brown without spots, abdomen does not extend beyond its margins; cervical grooves very broad, shallow, and form elongate depressions, contain no punctures and are prolonged posteriorly by a narrow superficial groove which extends beyond the middle point of the length; marginal grooves broad, shallow, slightly and finely punctured, commencing almost immediately behind the eyes, and terminating in a groove which separates the last from the following festoon; punctuations irregular, coarsest in front, fine and superficial over the remainder of the surface; behind are three wide, shallow, unpunctured longitudinal grooves, the middle one the longest; festoons longer than broad, slightly punctured, otherwise normal; eyes flat, yellowish, large, marginal. *Ventral surface* reddish brown, convexed with rather long and abundant whitish hairs; anus anterior of the middle of the length of the anal shields; and shields shaped like a scalene triangle, the inner edges longest, forming a long inner posterior spine, rectilinear in the anterior half, outer edge slightly convex, posterior edge concave and bordered by a row of large punctuations; adanal shields replaced by a prominent non-chitinous fold; no caudal prolongation but a chitinous thickening on the median festoon; stigmatic plates, whitish, narrow, comma-shaped. *Rostrum* with base almost twice as broad as long, lateral angles at about the middle of the length, posterior angles quite prominent; hypostome slightly spatulate, with six rows of teeth; palpi as broad as long, flattened dorsally, second segment scarcely longer than the third and retraced into a blunt point dorsally at its posterior border. *Legs* relatively strong; coxae covered with long white hairs, anterior summit much prolonged and conspicuous on the dorsal surface as an auricle, with two very long spines; on the posterior margins of the second and third coxae an external spine, flat, as broad as long, coxae IV divided on its posterior margin into two broad flat spines; tarsi of medium size, with two terminal spines.

Female.—Unknown.

Hosts.—Cattle.

Habitat.—Congo, Northern Transvaal, Mozambique.

This tick seems to be very closely related to *R. appendiculatus* and *R. lunulatus*. It was originally described from the Congo, and only a very few specimens have been found in the Northern Transvaal.

RHIPICEPHALUS APPENDICULATUS. NEUMANN.

THE BROWN TICK.

Rhipicephalus appendiculatus, Neumann (1901).

Plate VIII, figure *d* ; Plate IX, figure *d* ; Plate X, figure *d* ;
Plate XI, figures *b*, *d*, *g*, *i*, *k*.

Male.—Oval in outline, twice as wide at the posterior third as in front ; 3 to 4 mm. long ; reddish brown in colour. *Shield* (VIII, *d*) bordered by the body on the sides and behind ; of a dark brown colour ; a deep marginal groove limiting the last festoon ; cervical grooves very wide and short, but not very deep ; punctuations unequal, the small ones very numerous and superficial but quite apparent, the large ones rare and nearly all anterior, a few continue the marginal groove anteriorly from the eyes ; a space on each side near the middle of the length, where there are almost no punctuations ; posterior festoons twice as long as wide, except the extreme ones which are small and square or triangular ; all festoons continued into the margin of the body, the median is prolonged into a narrow tail twice as long as wide, truncate at tip ; in front of festoons are three longitudinal grooves, wide and short, the median a little the longest ; eyes flat, reddish in colour ; dorsal porose areas near the middle of the length. *Ventral surface* almost glabrous, punctured, anal plates triangular (IX, *d*), inner edge longer than outer, giving them the appearance of being pointed at both ends ; punctuations deep ; accessory plates lacking or very small. *Rostrum* with base relatively long, the lateral angles near the anterior third of the length, posterior angles prominent ; several large punctuations on dorsal surface of base ; palpi short and thick, articles angular on their outer edges, articles I and II prolonged backward on the ventral side ; mandibles with process of inner apophysis transverse and bidentate on inner edge, outer apophysis with two teeth, the terminal tooth small. *Legs* with coxae II, III, and IV, each with two teeth on their posterior margins, legs IV flattened dorso-ventrally ; tarsi II, III, and IV terminated by two consecutive ventral spurs.

Female.—When young, body oval, flat, reddish brown in colour ; when engorged body becomes elliptical, swollen, thick and almost as wide at each end, often reaches a length of 11 mm. and a width of 7 mm. *Dorsal shield* (X, *d*) an oval lozenge in shape, with sides slightly sinuous, rounded at angles ; almost as wide as long ; marginal grooves well formed, but not very deep ; punctuations numerous, unequal, mostly very fine and superficial, the remainder large, few in number, and scattered ; punctuations less numerous in an area on each side at about the middle of the length of the shield ; eyes large at the middle of the length of the shield. Integument of *dorsal surface* ordinarily provided with thinly distributed hairs, more abundant on the ventral surface ; when young, numerous punctuations on the dorsal surface ; a marginal groove on each side ; three longitudinal grooves ; eleven quadrangular posterior festoons ; integument often so thin as to allow ramifications of the intestines to show through when fully engorged ; two anterior and three posterior grooves ; dorsal porose areas in the anterior half of the length of the body, stigmatic plates oval, with a short postero-dorsal prolongation. *Rostrum* with base widened into prominent angles ; palpi comparatively smaller than those of the male, but more elongate ; first three articles bear three projections on their inner

ventral edges, as well as a row of stout spines, somewhat dentate ; the outer edge of article I strongly constricted, producing an apparent constriction of the rostrum at the base of the palpi ; porose areas of medium size, ovate in outline, and separated by more than their diameters ; hypostome with six rows of teeth, each row consisting of about 12 teeth ; mandibles (*XI, k*) with process of inner apophysis tridentate, outer apophysis tridentate, terminal tooth small and sub-ventral. *Legs* slender, dark brown in colour ; coxae longer than wide, coxae II, III, and IV each with two blunt teeth on their posterior margins ; stiff hairs on all the articles ; tarsi II, III, and IV each with two ventral spurs, the proximal one not so sharp.

Nymph.—Elliptical in outline ; when unengorged, 1.25 mm. long by 0.75 mm. wide ; when engorged, 4 mm. long by 2.25 mm. wide ; slightly wider in front than behind ; colour bluish. *Shield* (*XI, b*) small, dark brown in colour ; pentagonal in outline, deeply emarginate in front, antero-lateral edges straight and occupy fully two-thirds of the length of the shield ; posterior edges concave, but widely rounded in middle ; cervical grooves shallow, nearly straight, diverging slightly behind and nearly reaching the posterior margin ; lateral grooves very close to the margin, slightly concave, and reaching the posterior margin ; shield convex between the cervical grooves ; eyes at the lateral angles, small and shining ; shiny ; surface shiny and glabrous, with a few very large punctuations, mostly in the median area. *Dorsal surface* with numerous large papillae, distant from each other ; two anterior and three posterior grooves ; posterior festoons present. *Ventral surface* with papillae present only in posterior half ; genital grooves present and reaching almost to the posterior margin ; ano-marginal groove present ; stigmatic plates small, whitish, elliptical in outline. *Rostrum* (*XI, b*) light coloured, base wide and short, articulated by a slender neck ; lateral angles sharp ; palpi slender, articles elongate ; hypostome with four rows of teeth ; mandibles as in female. *Legs* slender, light coloured ; coxae I with a single median, posterior tooth, coxae II, III, and IV with two posterior teeth each (*XI, g*) ; tarsi elongate but thick.

Larva.—*Body* longer than wide ; widely rounded at both ends ; light reddish brown in colour ; length 0.75 mm., width 0.50 mm. ; when engorged, oval in outline, dark reddish or bluish in colour, 1.3 mm. long by 0.9 mm. wide. *Shield* as wide as long ; widely rounded behind ; antero-lateral edges very convex, allowing body to show for some distance before the lateral angle ; cervical grooves shallow ; eyes in lateral angles ; surface smooth, except for a few short spines. *Dorsal surface* (*XI, d*), when engorged, with two anterior and three posterior grooves ; festoons well marked. *Ventral surface* (*XI, d*) with genital grooves well marked ; ano-marginal groove deep ; festoons present ; stigmatic openings in four pairs, one behind each pair of coxae, and one pair near the posterior margin, in festoons next to the most anterior ones ; three pairs of spines between coxae ; several spines in posterior area. *Rostrum* with base wide and narrow, sides rounded ; palpi elongate, article I very short and almost invisible, articles II, III, and IV longer than wide ; article II constricted at base ; article III conical ; hypostome with four rows of teeth, about seven teeth in a row, and crenulations to the base ; mandibles as in female. *Legs* elongate but thick ; light coloured ; coxae I triangular, anterior end almost projecting beyond cervical angle of shield, one posterior tooth present ;

coxae II and III rectangular, coxae III with a small posterior tooth ; tarsi long and thick.

Eggs.—Light yellowish brown in colour ; elliptical in outline, surface smooth and shiny ; length 0.50 mm. by 0.30 mm. wide.

Hosts.—Cattle, horse, mule, sheep, goat, dog, rabbit, buffalo (*Bos caffer*), man.

Habitat.—Cape Colony, Transvaal, Rhodesia, Portuguese East Africa, Natal.

This tick is the principal agent in the transmission of the East Coast fever. It seems to be a general feeder on all warm-blooded animals, and is of very wide distribution over the whole of South Africa except in extremely dry places in the interior.

RHIPICEPHALUS BURSA. CANESTRINI AND FANZAGO.

Rhipicephalus bursa, Canestrini and Fanzago (1877-78).

Rhipicephalus bilenus, Pavesi (1883).

Rhipicephalus bursa, Canestrini and Fanzago (Neumann, 1897).

Plate VIII, figure *h* ; *Plate X*, figure *h*.

Male.—Length 4.5 mm. by 3 mm. wide, regularly widened from front to back, sometimes provided in the posterior extremity with a conical appendage. *Shield* (*VIII, h*) reddish brown, ordinarily covering all the dorsal surface, sprinkled with fine pores on all its extent, the largest on the borders, sometimes transparent and allowing the branches of the intestines to show through as black radiating lines ; cervical grooves short ; a short median groove in posterior portion, on each side of which are two rounded pits ; posterior margin divided into eleven rectangular festoons ; eyes pale, situated at the level of the posterior margin of coxae II. *Ventral surface* brownish red ; covered with fine hairs ; on each side of the anus a triangular plate, sides equal in length, base very wide, lateral of each of these plates, a straight spine, weak, often a little chitinous. *Rostrum* with base wider than long ; prominent lateral angles ; palpi rather short and thick and angular on their outer edges, articles I and II bearing on their inner ventral edges each a prominence, very marked on article I ; a row of stout spines, a little dentate on the inner ventral edges ; hypostome with six rows of teeth, each row composed of about 12 teeth ; mandibles with process of inner apophysis elongate transversely and tridentate, outer apophysis bidentate, terminal tooth very weak. *Legs* with coxae of their last pair, provided with two spines on their posterior margin, one in the middle, the other on the inner angle ; tarsi of the three last pairs terminated by two consecutive, well-developed claws.

Female (young).—*Body* oval, flat, reddish brown, 4 mm. long by 2 mm. wide ; (engorged) it is ovoid, swollen, thick, almost as wide at each end, and often attains a size of 17 mm. long by 9 mm. wide. *Dorsal shield* (*X, h*) an oval lozenge, with sides sinuous and rounded, almost as wide as long, hollowed by very numerous pores equal and evenly distributed ; eyes near the middle of the length, lateral grooves not well formed. *Dorsal integument* ordinarily provided with thinly distributed hairs, more abundant on the ventral surface ; when young, numerous punctuations on the dorsal surface ; a marginal groove on each side, three very deep grooves, the

laterals more prolonged in front, the median more prolonged behind, reaching almost to the posterior margin, which is divided into eleven quadrangular festoons, the integument often transparent, and allowing the ramifications of the intestines to show through as blackish, radiating lines. When fully engorged, two grooves in the anterior half, diverging behind and a little concave outward; three more in the middle posterior, of which a median, straight and two laterals, convex outward; stigmatic plates oval, with a prolongation, well marked, forming the postero-external angle. *Rostrum* with base widened into prominent points behind the insertion of the palpi, porose areas small, circular, and separated by more than their diameter; mandibles with process of inner apophysis elongate transversely and tridentate, outer apophysis tridentate, terminal tooth small and sub-ventral; hypostome a little spatulate, shorter than the palpi, provided with three rows of teeth on each half, almost equal in size, each row including about 12 teeth, of which the size diminishes a little from front backward; palpi short and strong, longer and more slender than in male, with sides not so angular, the first three articles bearing on their inner ventral edges three prominences, very marked on the first article; a row of stout spines, a little dentate, directed inward and forward, the outer edge of article I strongly constricted and concave, which produces a sort of constriction of the rostrum at the base of the palpi. *Legs* rather slender, dark brown; coxae longer than wide; those of the last three pairs provided with a small spine near the anterior external angle, and a blunt tuberosity on the external third of the posterior margin; stiff hairs on all the articles, especially on dorsal and ventral edges of third to last; tarsi of three last pairs terminated by a curved claw, preceded by a small blunt spine on the ventral edge.

Hosts.—The domestic animals, sheep, goats, cattle, horse, ass, dog; wild boar; hedgehog.

Habitat.—Southern France, Spain, Austria, Hungary, Italy, Corsica, Sardinia, Algeria, throughout West Africa and East Africa, Congo, Abyssinia, Cape Colony, Portuguese East Africa, Transvaal, Cuba, Haiti, Jamaica.

This tick has been frequently mistaken for the brown tick, which it very closely resembles. It is not of very common occurrence in the Transvaal, but seems to be more common in Northern Africa and Southern Europe.

RHIPICEPHALUS NITENS. NEUMANN.

THE SHINY BROWN TICK.

Rhipicephalus nitens, Neumann (1904).

Male.—*Body* oval, narrow in front, wide behind; length 4 mm. (rostrum included), width 2.5 mm; general colour reddish yellow. *Shield* shining, covering all the dorsal surface; cervical grooves not very deep; eyes flat, yellowish; marginal grooves well marked, extending from the eye to the extreme festoon; festoons very apparent, the median one smaller than the neighbouring ones, or almost as large; punctuations numerous, unequal, superficial, mostly very fine, the large ones distributed along the borders and irregularly in the anterior region. Anal plates semi-lunate, the inner edge very concave, the outer edge

curved, the two extremities pointed and almost similar, punctuations numerous; no accessory plates nor caudal prolongations. *Rostrum* with base twice as wide as long, marked with two or three large punctuations; the posterior and lateral angles salient; palpi shorter than the base, articles II and III of the same length, wider than long; article I very visible on its dorsal surface; prolonged in a retrograde point on the ventral surface; a retrograde spine ventral and anterior on article III; hypostome with six rows of teeth. *Legs* medium, not punctured, conforming to type; coxae I with an interior prolongation visible from the dorsal surface.

Female (young).—*Body* of the same form, dimensions, and colours as in the male. *Shield* shining, oval-lozenge shaped, scarcely longer than wide; cervical grooves deep at their origin, scarcely marked and almost joining the posterior edge; marginal grooves united at their origin to the cervical grooves, very superficial, reaching almost the posterior margin; punctuations unequal, numerous, superficial, larger near the latero-anterior edges, and in the middle space; eyes large, flat, greenish yellow, situated near the middle of the length of the shield. *Dorsal surface* shining, glabrous, with superficial grooves; a few scattered punctuations; posterior festoons present; marginal groove passing from the shield to the posterior limit of the penultimate festoon. *Ventral surface* wrinkled, glabrous, a little punctured. *Rostrum* conforming to the type; the base more than twice as wide as long, with posterior angles not prominent; porose areas large, oval, divergent, separated by more than their width. *Legs* long, slender, with punctuations superficial; long hairs on the ventral surface of all the articles.

Hosts.—Cattle, wild Cape dog.

Habitat.—Cape Colony, Transvaal.

The habits of this tick are very similar to those of *R. appendiculatus*, of which it may be only a variety, but more specimens of the adults are found on the face of the host, and the nymphs seem to require longer for engorgement. It is not very common in the Transvaal.

RHIPICEPHALUS SIMUS. KOCH.

THE BLACK-PITTED TICK.

Rhip. simus, Koch (1844, 1847).

Rhip. senegalensis, Koch (1844, 1847).

Rhip. praetextatus, Gerstäcker (1873).

Rhip. simus, Koch (Neumann, 1897).

Plate VIII, figure *f*; *Plate IX*, figure *f*; *Plate X*, figures *f*, *i*; *Plate XI*, figures *c*, *f*, *h*.

Male.—*Body* oval, rounded behind, where it is twice as wide as in front; length 4 to 6 mm. (without rostrum) by 2.2 to 3.5 mm. wide. *Dorsal shield* (*VIII*, *f*) a little convex, shining, very dark coloured, almost black, glabrous, covering all the dorsal surface, except on the largest individuals when it is bordered in front and behind by a narrow margin of the body; cervical grooves deep, wide and short, a little divergent; eyes large, yellowish, marginal groove deep, extending from the eyes to the anterior edge of the penultimate or ante-penultimate festoon; festoons elongate,

separated by deep grooves, punctuations unequal, the large ones very large and deep, in the marginal grooves they may be contiguous or almost so, they prolong the marginal groove anteriorly beyond the eyes by two lines of punctures, the remainder are arranged in four more or less regular, longitudinal lines in the middle area of the shield, the small punctures are evenly distributed over the shield, but distant from each other, and usually so fine and shallow as to be almost invisible; three posterior longitudinal grooves, very superficial; dorsal porose areas present at anterior quarter of length of shield. *Ventral surface* yellowish or brownish in colour; a few punctures; glabrous or with thinly scattered hairs; sexual orifice opposite the anterior edge of coxae II, sexual grooves diverging behind; anus chestnut brown in colour, opposite the middle of the anal plates, which are triangular, with the inner edge concave, outer edge convex, and posterior edge convex (*IX, f*); a chitinous point forms the accessory anal plates; eleven festoons present, the median one often prolonged in rectangular appendage; stigmatic plates elongate, comma-shaped. *Rostrum* with base wider than long; depressed in middle, the posterior angles prominent, lateral angles prominent at the anterior third of the length; mandibles (*X, i*) with process of inner apophysis transverse and bidentate, outer apophysis bidentate, the anterior tooth small; hypostome with six rows of teeth; palpi longer than wide, article II longer than article III, its inner dorsal margin longer than the outer; seven to nine hairs on the inner ventral margin; article I also with a ventral projection; article III wider than long. *Legs* reddish brown in colour, strong; articles somewhat flattened dorso-ventrally; tarsi short.

Female.—*Body* oval, a little wider behind than in front, may reach a length of 12 mm. by 8.5 mm. wide; colour brownish, with lighter colour marking the furrows and festoons. *Shield* (*X, f*) scarcely or not longer than wide; very dark, almost black in colour; shining; sides rounded or only slightly angular; punctuations numerous, unequal, large punctuations in middle and marginal areas; marginal grooves formed of a row of large pits, small pits evenly distributed, but usually so small and superficial as to be almost invisible; cervical grooves almost reach the posterior margin where they nearly join the marginal grooves; eyes shiny, flat, pale yellow, or often reddish in preserved specimens, a little behind the middle of the length of the shield. *Dorsal surface* of the abdomen lightly shagreened, in young individuals, punctuations large and occupied by whitish hairs; dorsal porose areas just posterior of the shield; marginal grooves at some distance from the margin, occupied by punctuations and hairs; four anterior grooves, the outer ones close to the corresponding marginal grooves and very long; three posterior grooves, the median longer; festoons well marked, elongate; when fully engorged the grooves and festoons are still faintly marked, usually by lines of a grey colour. *Ventral surface* of a uniform greyish or brownish colour, lighter than the dorsal surface; glabrous or with a few hairs; punctuations few and scattered; posterior festoons very apparent; sexual orifice opposite first inter-coxal space, sexual grooves diverging very rapidly behind coxae IV; anal groove well marked; ano-marginal groove present; stigmatic plates short, comma-shaped, with prolongations very short. *Rostrum* with base shorter than in male; mandibles (*X, i*) with process of inner apophysis bearing four teeth, outer apophysis tridentate; hypostome as in male, but longer; palpi similar to those of the male, only longer. *Legs* similar to those of the male, except that they are longer and more slender; tarsi relatively long.

Nymph.—*Body* oval in outline, widely rounded behind, narrower in front ; length (unengorged) 1.50 mm., width 1.0 mm. ; colour light brown. *Shield* (XI, c) quadrangular, narrow in front, sides diverging posteriorly, posterior edge wide and convex, cervical emargination shallow ; eyes at postero-lateral angles ; cervical grooves short, wide and shallow ; surface covered with numerous granulations ; colour darker near the anterior end. *Dorsal surface* with two anterior and three posterior grooves, numerous fine granulations and a few small whitish hairs ; festoons plainly marked. *Ventral surface* like dorsal ; genital grooves reaching nearly to posterior margin ; anal groove and ano-marginal groove well marked ; festoons present ; stigmatic plates elliptical in outline. *Rostrum* (XI, c) with base very wide and short ; lateral angles very prolonged and sharp at anterior quarter of length ; palpi slender, inserted on ventral surface ; article I very small, article II twice as long as wide ; article III not quite as long as article II ; pit on medio-ventral surface bears article IV ; hypostome slender, bears four rows of teeth with about seven teeth in a row ; mandibles as in female. *Legs* long and slender ; coxae all rectangular ; coxae I prolonged anteriorly, each coxae with two posterior teeth (XI, h) ; tarsi long, swollen in centre.

Larva.—*Body* oval, much longer than wide ; colour light yellowish brown, shield darker ; 0.50 mm. wide by 0.66 mm. long ; when engorged they reach a length of 1.50 mm. by 0.66 mm. wide, sides nearly parallel, widely rounded behind and narrowed in front ; colour dark reddish or bluish. *Shield* covers a little more than the anterior third of the body when engorged ; wider than long ; posterior edge only slightly convex ; lateral angles rounded, and not at margins of body ; deeply emarginate in front to receive the rostrum ; cervical grooves shallow, a few spines present. *Dorsal surface* (XI, f) with three to five grooves ; festoons well marked. *Ventral surface* (XI, f) with genital grooves and posterior grooves normal ; stigmatic openings in four pairs, one behind each pair of coxae, and the fourth in the fourth festoon from the central one ; three pairs of spines between coxae ; numerous spines in posterior portion. *Rostrum* on a long neck, base very wide and short, lateral angles very sharp ; palpi inserted on ventral side of rostrum ; palpi swollen in middle, constricted at base and conical at tip ; article I very short, article II wider than long, swollen at middle ; article III conical ; article IV in a pit on the median ventral surface of article III ; hypostome slender, four rows of teeth ; mandibles as in female. *Legs* thick ; coxae all quadrangular, coxae I with an anterior prolongation which projects beyond the shield and shows from dorsal surface ; each coxae with a single posterior tooth ; tarsi thick, conical at tip.

Eggs.—Light brown in colour, elliptical in outline ; surface polished ; length 0.5 mm., width 0.3 mm.

Hosts.—Dog, horse, hare, goats, sheep, rabbit, cattle, lion, bush-pig (*Potamochoerus choeropotamus*), hedgehog (*Erinaceus frontalis*), wild dog (*Lycaon pictus*).

Habitat.—Turkestan, Borneo, German East Africa, Abyssinia, Sierra Leone, Transvaal, Cape Colony, Madagascar, Mozambique.

This tick assists in the transmission of East Coast fever. It seems to be confined to the more humid areas of South Africa. In Cape Colony it is confined more to the coastal belt of summer rainfall. In the Transvaal it seems to be most common in the bush and low veld, and more rare in the south-west high veld.

GENUS AMBLYOMMA. KOCH.

Ixodes (ex. p.), Latreille (1795).*Amblyomma*, Koch (1844).*Amblyomma*, Koch (Neumann, 1899).

Eyes usually flat, slightly salient, sometimes hemispherical, shining, in a sub-marginal pit of the shield. Rostrum long; palpi valvate. Anal groove semi-circular, opening in front, uniting the sexual grooves; usually no median, ano-marginal groove. Dorsal shield often marked with designs in colour. No anal plates in the male. Stigmatic plates usually triangular, with rounded angles. Nearly always eleven posterior marginal festoons, at least in the male.

The presence of eyes separates this genus from *Ixodes* and *Aponomma*, and the absence of anal shields in the male from *Hyalomma*. Eyes are found in all degrees of development. Six forms are found in South Africa.

Males.

A. Eyes hemispherical.

B. Coxae I divided into two blunt spines; coxae IV with one blunt spine; coxae II and III unarmed *variegatum*.

BB. Coxae all with two short spines *sylvaticum*.

AA. Eyes flat.

B. Coxae I entire with a single long spine on posterior margin.

C. Ground colour light; anterior longitudinal line not joined by transverse line, and attenuated at posterior end, so as not to reach median transverse arched band.
hebraeum.

CC. Ground colour darker; anterior longitudinal lines of equal thickness, usually joined by transverse band, and reaching median transverse arched band.
hebraeum eburneum.

BB. Coxae I divided into two flat teeth.

C. Dorsal shield constricted at level of stigmatic plates; posterior festoons appearing like overlapping folds.
crenatum.

CC. Shield not constricted, festoons not folded
marmoreum.

Females.

A. Eyes hemispherical.

B. Shield triangular; dark coloured *variegatum*.

BB. Shield heart-shaped; light coloured *sylvaticum*.

AA. Eyes flat.

B. Coxae I with a long spine on posterior margin.

C. Anterior angles of dorsal shield and margin of cervical emargination dark coloured, like rest of shield; general colour of shield dark *hebraeum*.

CC. General colour of shield lighter; anterior angles and margin of cervical emargination light reddish grey in colour *hebraeum eburneum*.

BB. Coxae I divided into two wide teeth.

C. Cervical grooves simple *marmoreum*.

CC. Cervical grooves bifurcate *crenatum*.

Nymphs.

A. Metallic reflections on shield *hebraeum*.

AA. No metallic reflections on shield.

B. Shield reddish brown *variegatum*.

BB. Shield with a yellow bloom *sylvaticum*.

Larvae.

A. Body 0.7 mm. long (unengorged) *variegatum*.

AA. Body 0.75 mm. long (unengorged) *hebraeum*.

AMBLYOMMA HEBRAEUM. KOCH.

THE BONT TICK.

Amblyomma hebraeum, Koch (1844, 1847).

Amblyomma annulipes, Koch (1844, 1847).

Ixodes poortmani, Lucas (1850).

Ixodes poortmani, Lucas, (Belval, 1861).

Amblyomma hassalli, Marx and Neumann, (Neumann, 1899).

Amblyomma ebruneum, Gerstäcker (1873).

Amblyomma ebruneum, Gerstäcker, (Neumann, 1899).

Amblyomma hebraeum (male), Koch, (Neumann, 1899).

Amblyomma annulipes, Koch, (Neumann, 1899).

Amblyomma splendidum, Giebel (1877).

Amblyomma splendidum, Giebel, (Neumann, 1899).

Plate XII, figures a to h.

Male.—*Body* in a short oval, wider behind; length 5 mm. (rostrum not included), width 4 mm. *Dorsal shield* convex, covering all the upper surface; shining sulphur yellow, with spots and lines of a deep chestnut colour; cervical grooves short and wide; marginal grooves narrow, extending from the eyes to the posterior margin, where they form the anterior margin of the festoons, and are there wider than in the lateral portions; cervical emargination deep, almost square, a little wider than long, behind this emargination a sur-based triangular spot; from each anterior angle of the shield extend two dark coloured longitudinal parallel lines, the inner one covering the cervical groove; attenuated at its posterior end, and not reaching quite to an arched transverse line near the middle of the length of the shield, which passes laterally beyond the tips of these anterior longitudinal lines; near the end of the cervical grooves, the longitudinal lines swell laterally, forming a large dark spot; the second of the pair of lines, leaving the anterior angle of the shield, extends along the margin, becoming broad where it surrounds the eye, then constricted, and suddenly bending inwards; then extends longitudinally, until just below the extremity of transverse arched band, when it again extends outward to the margin of the outermost

festoon; this line is of varying width, sometimes wide, and again constricted; from its end, a dark line follows the lateral groove and the posterior end, forming the anterior margins of the festoons; a median dark line extends from the centre festoon, anteriorly to near the arched line, swollen at its tip, but does not join the arched line; on each side from the margin, a short dark line extends anteriorly; the festoons light coloured except the two extreme ones; lines of separation, chestnut coloured; dorsal porose areas present on posterior margin of the transverse arched band; punctuations equal, very fine, indicated by dark colour on the clear background; eyes flat, large, shining, surrounded by the dark spot on the margin. *Ventral surface* dirty sulphur yellow, sometimes with greenish or brownish tinge, glabrous; anus near posterior third, dark coloured; festoons dark chestnut, except the two extreme ones on each side, the inner of which has a dark spot on the median margin; five dark spots anterior of the chestnut coloured festoons; an elongate one opposite the median festoon; one opposite second festoon from median, which is circular, and an elongate one opposite extreme dark coloured festoons; stigmatic plates, triangular with rounded angles prolonged outward and backward; porcelain white, with orifice and border chestnut coloured. *Legs* long and thick, all the articles chestnut coloured, but ringed with lighter colour at their distal extremities, except the tarsi; coxae I with a long blunt spine on the posterior margin, a similar spine on the posterior margin of coxae IV; coxae II and III unarmed (*XII, h*); tarsi short and suddenly attenuated on dorsal extremity; tarsi II, III, and IV armed with two stout consecutive spurs; caruncle reaching scarcely to middle of length of claws. *Rostrum* (*XII, b*) 2 mm. long, narrow, base wider than long, sides rounded of a dark brown colour; digit of mandible strongly armed (*XII, c*); outer apophysis with one large curved tooth leaving a very tiny tooth on its cephalic edge; inner apophysis elongate, transverse bidentate; hypostome spatulate; tip bearing numerous denticles, then three longitudinal rows of teeth on each side of the anterior half, then four rows to middle of length, eight or nine teeth in each row, below these mere crenulations extending to base; palpi valvate on inner side, with article II slightly curved, and almost three times as long as article III, which is as wide as long; article IV small and conical, situated in a pit on the anterior ventral side of article III.

Female.—*Body* oblong, sides parallel, posterior margin widely rounded; 16 mm. long (not including rostrum), 14 mm. wide. *Shield* cordiform, wide in front, narrow behind, postero-lateral edges nearly straight, as wide or nearly as wide as long; cervical grooves well marked, very deep anteriorly, reaching almost to the posterior margin; no marginal grooves; general colour dark chestnut brown; central area between cervical grooves of a light metallic bronze colour, darker anteriorly, two lighter spots in each lateral area, punctuations few and large, remainder of shield reticulated; eyes shining, usually light coloured, but sometimes dark; large punctuations anterior, and mostly outside the cervical grooves, in lateral areas. *Dorsal surface* (*XII, a*) dark brown, when not fully engorged, with a reddish tinge, especially anteriorly and around margins. When fully engorged, olive brown in colour, darker on edges and reddish on caudal end, lighter about shield and legs; dorsal porose areas present at anterior quarter of length, dark coloured and raised from surface in fully engorged female;

two longitudinal grooves in anterior half, parallel and extending from margin of shield where cervical grooves emerge; lateral of each of these, another groove curved inward, and broken in the middle; on posterior half three grooves, one median and extending anteriorly between the base of the anterior median grooves, two lateral grooves curved sharply outward below the middle of the length; between each of these and the median groove, near lateral margin, a very short groove, also a short groove on each side of median groove near posterior margin. *Ventral surface* same colour as dorsal; sexual orifice opposite first intercoxal space; anus near posterior third, ano-marginal groove present; two short grooves lateral of it, one on each side; genital grooves turning sharply outward, and posteriorly below coxae IV. In unengorged females caudal festoons are well marked on both surfaces; stigmatic plates triangular, wide, with a sharp short point extending laterally, but not as long as in male, white, with orifice and margin dark brown. *Rostrum* a little longer than that of the male, base as long as wide, extending anteriorly over the mandibles, making it appear almost triangular; sides rounded; porose areas large, oval; digit of mandibles with outer apophysis bearing three teeth, anterior tooth very tiny, other two very large, posterior largest (*XII, d*); inner apophysis tridentate; hypostome elongate, resembling that of male. *Legs* and coxae as in the male, except that the spine of coxae IV is almost obsolete; tarsi as in male.

Nymph.—Unengorged nymph 2 mm. long by 1.5 mm. wide, broadly oval in outline, wider behind, resembling male in general contour, colour deep chestnut brown, lighter on the edge; posterior festoons well marked. *Shield* (*XII, e*) cordiform; postero-lateral edges emarginate near centre; eyes shining, dark coloured, large and slightly orbited; cervical emargination very shallow; cervical grooves deep, converging at first, then sharply diverging to middle of postero-lateral margin; surface of shield covered with small reticulations evenly distributed over its whole extent; colour deep chestnut brown; median area lighter, and of a metallic reddish colour in posterior half, shading to almost yellow at cervical emargination; reddish at angles of emargination. *Ventral surface* same colour as dorsal; stigmatic plates large and circular, opening eccentric; anus at posterior third. *Rostrum* (*XII, e*) light dirty yellow, base triangular on dorsal surface, pentagonal on ventral surface; palpi as in adult, only article III is longer than wide; hypostome with only two rows of teeth on each half; digit of mandibles as in female. *Legs* small and slender, light yellowish in colour; coxae small, rectangular in outline; coxae I bidentate; coxae IV with a single blunt tooth.

Larva (unengorged).—*Body* a very short oval, widest behind coxae III, nearly circular with five to seven festoons plainly marked; length 0.75 mm., width 0.60 mm.; colour light reddish brown. *Shield* (*XII, g*) covering front half of body, heart shaped, resembling that of female, postero-lateral margins nearly straight, longer than antero-lateral; posterior angle well rounded, cervical emargination shallow and wide with a reddish metallic lustre, cervical grooves well marked, nearly straight, and reach to the posterior margins; eyes large and dark coloured, flat at lateral angles of shield. *Ventral surface* (*XII, f*) same colour as dorsal surface; a large spine anterior of each emargination of the ten caudal festoons; three pairs of spines on intercoxal area; one pair opposite postero-median extremity of each pair of coxae; one pair of stigmatic openings between coxae I and II, another between II and

III, and one pair behind coxae III. *Legs* slender, light yellowish in colour; tarsi very long and slender; coxae I and II rectangular, coxae III triangular, with apex inward and widely rounded. Base of *rostrum* triangular on dorsal surface, with lateral angles sharp and prominent, pentagonal on ventral surface; palpi as in adult; hypostome with two rows of teeth on each half; digits of mandibles as in female.

Larva (engorged).—2 mm. long by 1.25 mm. wide, elongate, elliptical; sides parallel; broadly rounded at both extremities, colour dark chestnut brown, shield same colour as body.

Eggs.—Length 0.75 mm., width 0.30 mm.; colour light chocolate brown, surface smooth and shining. Towards hatching time a white spot appears, indicating region of the anus of embryo.

Hosts.—Most warm-blooded animals, chiefly cattle, also horses, asses, dogs, sheep, goats, ostriches, fowls, several species of the antelope, man, and found rarely on hares. It has also been taken from the following wild animals:—Giraffe (*Camelopardalis giraffa*), the rhinoceros (*Rhinoceros lucerius*), *Lycan pictus* in Cape Colony, *Boselaphus oreas* in British East Africa; buffalo, and elephant.

Habitat.—Cape Colony, Transvaal, Natal, Mozambique, German East Africa, British East Africa, Abyssinia, Congo.

This tick is most numerous along the southern and eastern coasts of South Africa, and is seldom found on the high veld, except in cattle recently brought up from the coast, although I have specimens collected at Pretoria, Middelburg, and Tzaneen Estate (Zoutpansberg). It transmits the disease known as heartwater to sheep and calves.

AMBLYOMMA HEBRAEUM, var. EBURNEUM. (GERSTACKER).

Amblyomma eburneum, Gerstäcker (1873).

Amblyomma eburneum, Gerstäcker (Neumann, 1899).

Amblyomma hebraeum, Koch, var. *eburneum* (Gerstäcker) (Neumann, 1904).

Male differs from the type as follows:—

General ground colour of shield darker; the anterior lateral bands are wide throughout their entire length, and not attenuated at their posterior ends; they also plainly join the median transverse arched band; the posterior median line also joins the central transverse arched band; a transverse band joins the anterior longitudinal bands, although this band may be obsolete or nearly so; all the dark coloured markings are much stronger and wider than in *hebraeum*; the rostrum is darker brown in colour.

Female differs from type as follows:—

In formaline or alcohol the body is of a brownish to yellowish green colour, while the type is always very dark, deep brown in colour. The shield bears in its posterior median area an irregularly rounded spot of reddish grey, which is continued anteriorly in the median area by a narrow longitudinal greyish line just inside each cervical groove; these lines may, however, be so wide as to become confluent; the anterior angles and the margin about the cervical emargination are also greyish in colour; the general colouration of the shield is of a lighter shade than in *hebraeum*; the rostrum is also of a lighter colour. Unengorged females of *eburneum* are wider and fuller anteriorly than those of *hebraeum*.

Hosts.—Same as *hebraeum*.

Habitat.—Same as *hebraeum*.

A careful study of my specimens of these two forms shows that they are very difficult to distinguish one from the other, and that there are many intermediate forms which might be included under either form. I find that in specimens of males which are plainly *eburneum* the transverse line connecting the two anterior longitudinal bands running along the cervical grooves is more often not present than present; also the posterior median dark line does not always run completely into the transverse median arched band. The differences between the type and the variety seems to be mainly one of intensity of colouration. In the females I also find the variations slight, although they are more easily distinguished than the males. I find that in the type occasionally the posterior median light coloured area may be extended anteriorly by two light coloured lines, which may be even confluent as in *eburneum*, but these areas are always of a dark bronzy colour in the type instead of a reddish grey as in the variety. The eyes of *hebraeum* seem to be usually of a darker colour than those of *eburneum*, but *hebraeum* never has the light coloured anterior margin to the shield which is present in *eburneum*, nor is the body of partly engorged females ever of the light colour which seems characteristic of *eburneum* females when in preservative fluid.

AMBLYOMMA VARIEGATUM. (FABRICIUS.)

THE VARIEGATED TICK.

Acarus variegatus, Fabricius (1794).

Ixodes elegans, Guérin-Ménéville (1829-1843).

Amblyomma venustum, Koch (1844, 1847).

Amblyomma variegatum (Fabricius) (Neumann, 1896.)

Plate XII, figures *k, l*; *Plate XIII*, figures *a, b*.

Male.—*Body* oval, wider behind, 5 mm. long (rostrum not included) by 3.5 to 4 mm. wide. *Dorsal shield* convex, covering all the upper surface, deep reddish brown, with copper-red spots, bordered with metallic green; cervical grooves short and deep; marginal grooves narrow, commencing a little behind the eyes, contouring the posterior margin, from which it is further distant than from the lateral edges, forms the anterior borders of the festoons; behind the cervical emargination, a copper-red spot, equal to about a third of the width, wider behind, where it is bordered by a curved, brown band; on each side of this spot is another, irregular longitudinal, concave inward, approaching the eye, on the corresponding side, with its anterior extremity, sometimes united to the median spot by a part of its inner margin, and continuing behind by a wide median spot which occupies almost all the width, and is separated from the marginal groove by a brown line, this latter is prolonged on the median line in a very narrow line, and may have another triangular prolongation in front opposite the penultimate festoon; festoons elongate, reddish brown, bordered with yellowish white the same as all the contour of the body; punctuations scattered, ordinarily not very deep, unequal; eyes hemispherical, shining, anterior, brownish or yellowish, in orbits. *Ventral*

surface often swollen, greenish grey, with the marginal chitinous, reinforcements brownish, separated by grooves and corresponding to the dorsal festoons; sexual orifice opposite coxae II, wide, anterior valve chitinous, sexual grooves at first almost parallel, then very divergent between coxae IV and the anus; anus near the posterior quarter; hairs very short on all the ventral surface; stigmatic plates white, with chestnut margins triangular with rounded angles, the postero-lateral angles well marked. *Rostrum* (XIII, a) 2 mm. long; base concave on its posterior margin, lateral margin convex; mandibles (XII, k) with inner apophysis sub-terminal, transverse, festooned in three points, one median, and two lateral, of which the inner is elongate transversely; outer apophysis with two teeth, the terminal small, the other very strong; hypostome a little spatulate, numerous denticles on the tip, followed by three then by four rows of teeth on each half, which gradually diminish and become squamiform on the basilar half of the organ; palpi 1.4 mm. long; article I with its ventral surface twice as long as the dorsal and prolonged on the inner edge by an obtuse point over article II; article II twice as long as article III, and prolonged on its extero-dorsal base into a flat point over the first; hairs rather long on the two edges of the convex surface of articles II and III. *Legs* thick, reddish brown; coxae contiguous (XII, l); coxae I divided into two blunt spines; the outer longer; coxae IV with a single strong spine; coxae II and III unarmed; the other articles, save the tarsi, ringed with whitish colour on their distal extremities; tarsi I at least four times as long as wide, suddenly attenuated near the extremity; tarsi II, III, and IV at least three times as long as wide, with two strong consecutive spines; caruncle reaching scarcely to the middle of the length of the claws; short hairs on all the articles.

Female.—*Body* almost the same form as in the male, relatively narrower, dimensions ordinarily a little larger, even when young; colour generally deep greenish brown, except the shield, the rostrum, and the legs, which are deep reddish brown. *Shield* triangular in its posterior two thirds, with posterior angle rounded, a little wider (3 mm.) than long, deep brown, sometimes with a reflection or spot of greenish metallic red in the centre or near the posterior angle and the origin of the cervical grooves; cervical grooves deep in front, prolonged almost to the posterior margin; punctuations deep, large, unequal, very numerous, often contiguous; eyes near the anterior quarter, similar to those of the male. *Dorsal surface* unicoloured, deep green, a marginal groove situated at a nearly uniform distance from the margin, forming the anterior margin of the eleven posterior festoons, which are scarcely longer than wide. A median groove, extending from the median festoon to a certain distance from the shield; two lateral grooves, concave outward, beginning at the space between the penultimate and antepenultimate festoons; punctuations deep, equal, scattered over all the surface. *Ventral surface* deep green, similar to that of the male; sexual orifice narrower; marginal festoons not chitinous; an ano-marginal groove; stigmatic plates larger. *Rostrum* (XII, b) 2.6 mm. long, similar to that of the male, except in the following particulars: porose areas present and large, oval digit of mandibles with inner apophysis bicuspid, base swollen; outer apophysis with three teeth, the two posterior strong. *Legs* rather longer, hairs rather long; spine of coxae IV reduced to a flat tuberosity; the penultimate tarsal spine attenuated, often almost effaced.

The fecundated and engorged female can reach the largest dimensions of the family (24 mm. long by 15 mm. wide, and almost as thick). At first

it is the same colour as in earlier stages, but later it becomes nutmeg brown. The body is at first rectangular, with rounded angles, and faces only a little convex, then it becomes more and more swollen ; coxae very distant ; no grooves or festoons.

Nymph.—*Body* brownish, 2 mm. long (rostrum included), the shape of a young female. *Shield* without metallic reflections, reddish brown. *Coxae* with spines scarcely visible ; no tarsal spines.

Larva.—*Body* oval, swollen, 0.7 mm. long.

Hosts.—Cattle principally, but also horses, goats, rhinoceros (Mocambique, German East Africa, Abyssinia), zebra, and sheep.

Habitat.—Abyssinia, Zanzibar, Madagascar, Mauritius, Senegal, Congo, Ivory Coast, Sierra Leone, River Niger, River Zambesi, Transvaal, Cape Colony, Manicaland (Rhodesia), German East Africa, Mocambique, Angola, Togo, Guinea.

Life History.—Never reared in Transvaal, but Lounsbury has tried and found that it was practically the same as *A. hebraeum*. It always leaves the host to moult. This tick is very closely related to *hebraeum*. It is confined, however, mostly to tropical Africa, and is only occasionally taken in South Africa. It has become naturalised in Guadeloupe Islands, where it seems to have been taken from Senegal.

AMBLYOMMA MARMOREUM. KOCH.

THE TORTOISE TICK.

Amblyomma marmoreum, Koch (1844, 1847).

Hyalomma devium, Koch (1844, 1847).

Amblyomma devium (Koch) (Neumann, 1899).

Amblyomma rugosum, Neumann (1899).

Amblyomma marmoreum, Koch (Neumann, 1901).

Plate XII, figures *m*, *n* ; *Plate XIII*, figures *c* to *k*.

Male.—*Body* oval, reaching 8.5 mm. long (not including rostrum), by 7 mm. wide. *Dorsal shield* (*XIII*, *c*) a little convex, punctuations unequal, fine ones very numerous and very fine, the others very large, scattered, showing granulations at their bottoms ; cervical grooves narrow and deep ; marginal groove deep at a distance from the margin, beginning about at level of coxae III, and contouring the posterior margin, where it forms the anterior margin of the festoons very distinctly ; anteriorly it is indicated by a row of punctuations more or less regular ; general colour light grey, with a metallic copper tinge, and with dark brown spots as follows : Two narrow bands on the cervical grooves ; behind these two rectangular areas separated behind, but joined in their middle by a transverse line in the posterior third ; three bands converging in front, enlarged, or not in their anterior extremity, on the marginal cushion, in front of the festoons, three to five successive spots, the anterior of which borders on the outer edge of the eye ; the festoons bordered with brown on their inner edges. *Eyes* large, flat, yellowish. *Ventral surface* light greyish in colour, the festoons marked by brown spots and grooves of separation ; a dark line anterior of median, and festoons second from median ; stigmatic plates triangular ; postero-lateral angle prolonged laterally. *Rostrum* rather short, dark coloured, base small, rectangular on posterior margin ; metallic spot on

dorsal surface; palpi short and thick; article II curved toward the ventral surface, twice as long as article III; hypostome with numerous denticles at tip; followed by seven or eight rows of strong teeth, three to a row; below this numerous squamiform teeth; from middle of hypostome downward a fourth row of small teeth along median line; inner apophysis of mandible transverse, unidentate (*XII, m*); outer apophysis bidentate. *Legs* strong, chestnut brown, ringed with lighter colour at distal extremities of articles; marked with punctuations; coxae I with two short, flat spines, a single spine similar to these, but stronger, on coxae IV (*XII, n*); tarsi short, thick, suddenly attenuated.

Female.—Unengorged, female a little larger than male; when engorged, body oval, flat, reaches dimensions of 33 mm. long by 20 mm. wide. *Shield* (*XIII, d*) triangular, scarcely wider (4 mm.) than long; posterior lateral sides almost straight; posterior angle narrow; scapular angles prominent in anterior points; eyes in anterior third of length; cervical grooves deep and wide, prolonged almost to the posterior margin; punctuations unequal; large ones rare; fine ones numerous, marked on light areas by black spots; ground colour bronzy grey as in male, and with spots of brown along the anterior margins, on the cervical grooves around the eyes, on the posterior margin opposite the cervical grooves, and near the posterior third of the lateral areas; eyes flat, whitish, brown when in preservative fluid. *Dorsal surface* (*XIII, d*) deep red-brown, wrinkled and deeply punctuated; a marginal groove; eleven posterior festoons well marked, dorsal porose areas present. *Ventral surface* reddish brown; posterior festoons very apparent. When engorged, body becomes light brownish grey, with a few salmon coloured blotches, surface usually covered with a whitish bloom; dorsal and ventral surface with grooves as in *hebraeum*; stigmatic plates large, whitish, triangular, with angles rounded; posterior lateral angle prolonged laterally, but not so much as in male. *Rostrum* 2.5 mm. long, reddish brown; porose areas of medium size, almost circular; hypostome spatulate, numerous denticles at tips, eleven rows of teeth on each half, three teeth to a row; squamose denticles to base; inner apophysis of mandibles with process transverse, tridentate (*XIII, e*); outer apophysis tridentate; palpi curved toward the ventral surface from the base of article II, wide, with parallel edges, otherwise similar to those of male. *Legs* long, strong, chestnut brown, ringed with lighter at distal ends of segments. Coxae I with two short teeth, strong, flat, separated; a triangular prominence flat, on the posterior margin of the others, larger on coxae IV; tarsi II, III, and IV sharply attenuated near their extremity.

Nymph (engorged).—*Body* widely elliptical, broadly rounded on both ends, with sides nearly parallel; up to 9 mm. long by 6 mm. wide; colour dark bluish, changing to a bright brown toward moulting time, and often covered with a coarse brown bloom. *Dorsal shield* (*XIII, h*) a little wider than long, broadly rounded on posterior angle, posterior lateral edges nearly straight; colour uniform dark brown, cervical grooves deep, then broad and shallow, extending nearly to posterior edges; punctuations unequal, large ones very large; eyes at lateral angles light coloured. *Dorsal surface* smooth, four anterior furrows; outer ones broken in middle; three posterior furrows, reaching nearly to the posterior margin, where there are two short furrows between their extremities. *Ventral surface* with furrows as in female; stigmatic plates whitish with dark

margins, slightly elliptical, with elongation extending postero-laterally ; anus at posterior third of length. *Rostrum* (XIII, *h*) short, dark brown in colour ; dorsal surface of base triangular in outline ; palpi elongate and slender ; article II more than twice as long as article III ; hypostome spatulate, denticles on its tip, followed on each half by one row of four teeth, then by six or seven rows of strong teeth, two to a row, squamose denticles to base ; mandibles with process of inner apophysis of digit tridentate, outer apophysis bidentate, with two small denticles on anterior edge of anterior tooth. *Legs* short, slender, dark reddish brown in colour ; coxae each with a wide, sharply pointed spine on the posterior margin ; tarsi short and thick, not sharply attenuated at terminus.

Larva (unengorged).—Colour light yellowish brown, shield darker, oval in outline, slightly longer than wide ; length 0.75 mm., width 0.50 mm. *Shield* covers anterior third of body, much wider than long, broadly rounded behind, surface reticulated ; cervical grooves deep and straight, almost reaching the posterior margin ; no marginal groove ; cervical emargination very deep ; eyes flat, at lateral angles, small, yellowish. *Dorsal surface* (XIII, *k*) with a long median groove ; a marginal groove extending all round the body, forming the limit of the festoons, and in dried specimens causing the edge of the body to turn up sharply ; festoons large, well marked. *Ventral surface* (XIII, *i*) with three posterior grooves, radiating from the anus, which is anterior of the posterior third ; festoons well marked ; marginal groove not marked ; stigmatic openings large in three pairs, one pair posterior of each pair of coxae. *Rostrum* wide and narrow on dorsal surface ; lateral angles sharply pointed, posterior margin straight ; articulated with shield by a very long neck ; ventral surface more or less rectangular in outline, lateral angles not prominent ; hypostome spatulate, with denticles at tip, then four rows of large sharp teeth, seven teeth in each row ; mandibles (XIII, *g*) with outer apophysis bidentate, the anterior margin of the anterior tooth bearing a crest composed of two larger teeth, on the inner edge of them a row of saw teeth ; inner apophysis with process tridentate ; palpi long and slender, article I very short, cylindrical ; articles II and III of about equal length, swollen at their anterior ends ; article II very much constricted at its base, anterior half and article III concave on their inner edges. *Legs* thick, almost translucent in colour ; coxae large, well separated from each other, coxae I triangular, coxae II and III rectangular in outline, each with two wide blunt teeth on posterior margin, almost unnoticeable on coxae III ; tarsi normal.

Eggs.—Small, elliptical, surface smooth and shining ; 0.75 mm. long by 0.3 mm. wide ; colour light reddish brown, singly, but in a mass dark reddish brown.

Hosts.—Tortoise, rhinoceros (*Rhinoceros lucerius*), snakes. Larvae and nymphs also feed readily on ox and goat, and on some kinds of birds and lizards.

Habitat.—Cape Colony, Transvaal, German East Africa, British East Africa, Zanzibar, Upper Zambesia.

This tick is a very common parasite on tortoises in South Africa. It does not seem to be influenced by climatic conditions to the same extent as the two last-mentioned species, being found alike in the dry, semi-desert regions, and in regions of abundant rainfall. Nymphs and adults are found in large numbers on tortoises.

AMBLYOMMA CRENATUM, NEUMANN.

THE RUFFLED TICK.

Amblyomma sublutum, Neumann (1899).*Amblyomma crenatum*, Neumann (1899).

Plate XII, figure i.

Male.—*Body* a short oval, sides rounded, 7 mm. long (without rostrum), 6.5 mm. wide. *Shield* a little convex, dirty yellow, with a thin whitish bloom in the scapular angles and on the sides; in the middle a brownish, narrow band, prolonged to the lateral margin by a wider band, not distinctly limited; near the posterior quarter, a median irregular spot of the same colour, joined in front to the transverse border by two curved lines, and giving off behind three short prolongations, of which one is a median. *Eyes* large, flat, scarcely paler than the shield and finely bordered with brown; cervical grooves short and deep; marginal groove narrow; not very deep, contouring the posterior margin, from which it is twice as far removed as the lateral margin; festoons narrow, at least twice as long as wide; punctuations numerous, large, equal, not very deep, regularly distributed, and of the colour of the shield; among them some punctuations more numerous, very fine, superficial, brown. A posterior constriction, well marked, at the level of the stigmatic plates. *Ventral surface* of the same colour as the shield, glabrous; posterior festoons very apparent, not limited in front, marked in the middle by diffuse brownish spots; stigmatic plates large, whitish, comma-shaped, with tail short, projecting outward. *Rostrum* very large (3 mm.), brownish; base a little constricted behind, posterior angles scarcely salient, very finely punctured; hypostome armed, in its anterior third, with three rows of strong teeth on each half; palpi long, brownish, the second article more than twice as long as the third. *Legs* very long, strong, intermediate articles yellowish white, the fourth reddish in the middle, the fifth in its proximal half; coxae I divided into two large spines, the outer strong and sharp, the inner wide and a half shorter; a long blunt spine on coxae IV; tarsi relatively long, with two strong consecutive spurs.

Female.—*Body* in a short oval; sides rounded; flat; 9 mm. long (without rostrum), 8 mm. wide. *Shield* (XII, i) triangular, a little wider (5.2 mm.) than long; cervical emargination prolonged in front by two points, anterior margins a little oblique, the latero-posterior almost straight, posterior angle wide and a little rounded; cervical groove at first straight and very divergent, then bifurcate, the inner branch bordering on the median area, the outer short; median area a little salient; punctuations numerous, unequal, abundant, and confluent about the eyes; colour reddish yellow, with a yellowish white bloom on the lateral areas, along the cervical margin and in the posterior angle; a small brownish marginal spot on each side at the posterior third of the lateral border. *Eyes* large, flat, relatively anterior, yellowish. *Dorsal surface* (XII, i) reddish brown, pitted with numerous and large punctuations; a marginal groove, bordering the posterior festoons in front, which are longer than wide, inner margins longer than outer, giving a crenulate aspect to the posterior margin of the body. *Ventral surface* of the same colour; punctuations finer, surmounted by fine hairs; stigmatic plates large (2.6 mm. long), triangular angles rounded. *Rostrum* (XII, i) very

long (4 mm.) ; base wider than long ; hypostome a little spatulate, armed, on the interior half, on each side with three longitudinal rows of 8 to 10 teeth each, the outer row longer, the inner removed from its neighbour and doubled behind by a fourth shorter row ; squamiform denticles behind the teeth ; palpi with the third article as wide as long, dilated on its inner dorsal margin. *Legs* very long, strong ; coxae I bicuspid ; the others flat, and a little attenuated on their posterior margin ; tarsi long, sharply attenuated at their extremity, two strong terminal spines, claws long, caruncle short.

Hosts.—Rhinoceros.

Habitat.—Sumatra (?), Cape Colony.

I have never seen a specimen of this species. The description is taken from Neumann.

AMBLYOMMA SYLVATICUM, (DE GEER).

THE CAPE TORTOISE TICK.

Acarus sylvaticus, De Geer (1778).

Cynorhaestes sylvaticus, Hermann (1804).

Amblyomma sylvaticum, Koch (1844).

Hyalomma devium (female), Koch (1847).

Ixodes sylvaticus, Gervais (1844).

Amblyomma sylvaticum (De Geer) (Neumann, 1899).

Male.—*Body* regularly oval ; sides rounded ; 4.5 mm. long (rostrum not included), 3.2 mm. wide. *Shield* chestnut brown, lighter on the margin, convex ; cervical grooves short, deep, lunate ; no marginal groove ; posterior festoons with separations not very deep ; punctuations numerous, deep, very unequal, some disposed in a series replacing the marginal groove on the sides ; eyes small, shining, hemispherical, submarginal in an orbicular excavation ; on the margins and on the last penultimate festoon an irregular spot, yellowish white, or reddish yellow. *Ventral surface* yellowish ; stigmatic plates in a short comma, bordered with whitish. *Rostrum* chestnut brown, 1.7 mm. long, base relatively long and narrow ; hypostome wide spatulate, with numerous anterior denticles, of which the marginal ones are bifid or trifid, followed on each half by four rows of eight teeth each, decreasing from front to back ; numerous posterior squamose denticles ; palpi of medium length, spotted with whitish on the inner margin of their upper surface. *Legs* of medium length ; coxae small, all with two short points on their posterior margins ; movable articles whitish on their dorsal border ; tarsi sharply attenuated at their extremity ; a terminal spur, very small on tarsi II, III, and IV ; caruncle scarcely passing the base of the claws.

Female.—*Body* oval, 6 mm. long (not including rostrum), 5 mm. wide. *Shield* oval, cordiform, as wide or wider than long, whitish yellow in the larger part of its extent ; a border of blackish brown on the sides, narrow, except at the level of the eyes, which it surrounds ; cervical grooves deep in front, reaching almost to the posterior margin, covered by a blackish band in the middle of the lateral area, a small black spot ; punctuations deep, unequal, black ; sometimes a brown spot in the median area ; eyes as in the male. *Dorsal surface* reddish brown ; when young a marginal

groove stopping at the penultimate or antepenultimate festoon ; festoons well marked ; punctuations deep, distant ; hairs scattered, rather long. *Rostrum* as in male, often a yellow spot between the porose areas ; long hairs on the palpi. *Legs* as in male. Engorged female can reach to 15 mm. long by 11 mm. wide.

Nymph.—Form of the female, shield relatively wider ; yellow bloom less extended.

Habitat.—Cape Colony.

Hosts.—Tortoise, deer.

I have not seen this species, and have taken the description from Neumann.

GENUS APONOMMA, NEUMANN.

Ixodes (ex. p.), Latreille (1796).

Ophiodes, Murray (1879). (Name preoccupied.)

Aponomma, Neumann (1899).

No eyes. Base of rostrum usually pentagonal, with latero-dorsal edges very short. Palpi long. *Male* with body wider or almost as wide as long ; ventral surface naked ; sexual grooves very divergent behind, anal groove semi-circular or pointed, opening in front, joining the sexual grooves ; ano-marginal grooves median ; dorsal shield covering all the upper surface, and usually marked with metallic green spots ; stigmatic plates comma-shaped. *Shield of Female* shorter or scarcely longer than wide, usually marked with metallic green spots, disposed in a triangle ; grooves on the ventral surface as in the male ; stigmatic plates shorter, less attenuated at the postero-external extremity.

This genus occurs almost exclusively on snakes and lizards, although *Aponomma exornatum* is reported as having been found in South Africa on a dog. From the colouration and grooves on the ventral surface it would seem to be closely related to the genus *Amblyomma*. It differs from that genus, however, by the absence of eyes and the form of the body. The absence of eyes and length of rostrum have generally made species of this genus rank among the *Ixodes*, from which they differ, however, by the general conformation. Only three forms are reported from South Africa.

Male.

A. Shield marked with nine metallic green spots. *exornatum*.

AA. Shield uniform, pale brownish, without metallic green spots.

B. Tarsi II, III, and IV attenuated at extremity

BB. Tarsi with a bosse at extremity *laeve capense*.
latum.

Females.

A. Shield marked with three metallic green spots ; shield as long or longer than wide ; punctuations fine, close *exornatum*.

AA. Shield uniform, reddish brown, without green spots ; wider than long ; punctuations small and few.

B. Coxae I with blunt, flat spurs, punctuations on dorsal shield obsolete *latum*.

BB. Spines on coxae I sharp ; punctuations small and few
laeve capense.

Nymphs.

- A. Eye-like reddish spot on each antero-lateral angle of shield, which is nearly colourless otherwise. *laeve capense*.
 AA. Shield dark reddish brown, except postero-median area, which is lighter, no reddish eye-like spot on shield *exornatum*.

Larvae.

- A. Dorsal shield uni-colour, no eye-like reddish spots present. *exornatum*.
 AA. Dorsal shield with eye-like reddish spots in antero-lateral angles. *laeve capense*.

APONOMMA EXORNATUM. (KOCH.)

THE LIZARD TICK.

Amblyomma exornatum, Koch (1844, 1847).

Ixodes flavomaculatus, Lucas (1846-51-67).

Ophiodes flavomaculatus, Murray (1879).

Ixodes varani, Lewis (1892).

Aponomma exornatum (Koch) (Neumann, 1899).

Plate XIV, figures *a* to *i*; *Plate XV*, figures *a* to *c*, *f*.

Male.—*Body* short, almost as wide as long, somewhat quadrangular or orbicular, length 3 mm. to 5 mm. (rostrum included), width 2.5 mm. to 3.3 mm. *Shield* covers all the dorsal surface, glabrous, punctuations very small, somewhat unequal, distributed over all the surface; cervical grooves very short, wide and deep; eleven posterior festoons with separating grooves short and rather shallow; dorsal porose areas just below the middle of the length, small and widely separated; ground colour of shield a deep reddish brown, lighter on the edges, on this is arranged nine large metallic green spots, sometimes almost invisible, as follows:—Two short sub-triangular spots, one in each cervical angle, next the insertion of the rostrum; two linear marginal spots, one behind each of the cervical spots, a spot inside each of these linear spots, converging anteriorly at about the same level, and extending backward, passing them laterally by a widening of their posterior ends; two posterior spots separated by the median line, and close to the festoons a median spot, somewhat rectangular, and not far posterior of the extremities of the cervical grooves. *Ventral surface* (*XIV*, *a*) reddish yellow; many small equal punctuations, especially near the anus; festoons showing slightly on the posterior margin; sexual orifice rather wide opposite coxae II; sexual grooves widely divergent behind coxae IV, reaching nearly to the margin; anus very far caudad; anal groove semi-circular, opening forward; ano-marginal groove short; stigmatic plates large sub-triangular, elongate, postero-laterally, narrow in front. *Rostrum* (*XIV*, *b*) narrow, base nearly twice as wide as long on dorsal surface, rounded on the sides; mandibles (*XIV*, *c*) with inner apophysis of digit bearing a simple transverse process; outer apophysis with a single strong tooth; hypostome spatulate, with numerous denticles anteriorly, followed by three longitudinal rows of teeth on each half, consisting of seven to eight teeth each, then a series of squamiform denticles cover the rest of the organ to near the base; palpi

long, article I small and narrow, article II attenuated at its base, at least twice as long as article III, article IV very small, hidden in a pit near the extremity and on the ventral surface of article III with numerous terminal hairs; marginal hairs on articles II and III. *Legs* brownish, of medium length, thick and swollen, hairs rare and short; coxae rather long, a single short spine on the postero-median margin of each; tarsi at least three times as long as wide, a large bosse near the extremity and on the dorsal side of each, two consecutive spurs, the terminal larger, on coxae II, III, and IV; caruncle short, scarcely reaching a quarter of the length of the claws.

Female.—*Body* thick, wider behind than in front, widely rounded at the two extremities; colour generally reddish brown; reaching a length of 7 mm. and a width of 5 mm. or more. *Shield* heart shaped, as long as wide, contour a little sinuous, posterior angle rather narrow, well emarginated in front, glabrous; cervical grooves wide, deep, and short, prolonged backward by a superficial groove, which is concave outward; punctuations, fine numerous, three metallic green spots as follows:—One in each cervical angle, bordering on the cervical grooves, and one on the posterior angle; sometimes the spots are very faint in colour, but always more or less sharply defined. *Dorsal surface* with four anterior grooves, short and symmetrical, followed by three shorter grooves, and finally by three or five grooves, which are long and close to the median line; hairs very short, scattered; punctuations fine, scattered, porose areas just posterior of shield, widely separated. *Ventral surface* with colour, punctuations, and hair as on dorsal surface: sexual orifice narrow, a little in front of the level of coxae II; sexual grooves very widely separated behind; anus near the posterior quarter of the length of the body; anal groove semi-circular, opening forward; ano-marginal groove long, a short groove on each side of it, in partly engorged females; stigmatic plates large, triangular, transverse. *Rostrum* (XIV, g) rather large, narrow, nearly as long as shield; base with dorsal surface nearly as long as wide, rounded on the sides; porose areas large, deep, slightly elongate longitudinally; digit of mandibles with inner apophysis strong, conical, base thick, point recurved, with the transverse process near the tip, outer apophysis with three teeth, strong, largest near the base; hypostome with denticles at tip, then six to seven large teeth in a row, crenulations to base (XIV, d); palpi as in male. *Legs* as in male; coxae bearing one spine on their postero-median margin (XV, e); tarsi as in male, except that only on tarsus I is the bosse near its extremity very prominent (XIV, i).

Nymph.—*Body* flattened, wider behind, broadly rounded at both extremities, almost orbicular; colour dark reddish brown; length 2.3 mm. (without rostrum), width 2 mm. *Shield* (XIV, e) dark chestnut brown, postero-central area and posterior edge of the cervical emargination a little lighter; heart shaped; as wide as long; widely rounded behind; postero-lateral edges concave; antero-lateral edges convex; punctuations few but large, and of equal size; cervical grooves deep at first, then shallow and diverging toward the margins; cervical emargination shallow. *Dorsal surface* with a few large punctuations and a few whitish short hairs; four short anterior grooves, followed by a set of two short lateral grooves on each side, one anterior of the other, and these in turn by three long grooves, one median and two lateral, which diverge posteriorly, with the addition of a short groove on each side of

the median groove at its extremity; caudal festoons faintly indicated. *Ventral surface* (XV, a) of same colour as dorsal surface; genital grooves beginning opposite coxae IV, and widely diverging; anal groove semi-circular and opening in front; ano-marginal groove long and deep, a small groove on each side of it; stigmatic plates elliptical transverse (XIV, f). *Legs* light brown, short and thick; coxae elongate, like those of the female. *Rostrum* small, narrow, base triangular on the dorsal surface, as long as wide, rectangular on the ventral surface, twice as wide as long, sides rounded; hypostome spatulate, many small denticles at its tip, then three rows of teeth on each half, consisting of eight or nine large sharp teeth, below these numerous squamiform teeth, extending to near the base; mandibles as in the female; palpi elongate, thicker than in adults; article I very short and almost glabrous; article II constricted at its base, and twice as long as article III; article IV small, papilliform, and arranged as in adult.

Larva.—Nearly circular in outline; engorged larva 0.75 mm. wide by 1 mm. long, including rostrum; colour light yellowish brown, with shield and rostrum darker reddish brown; integument finely wrinkled; festoons well marked. *Shield* (XV, f) heart shaped, finely reticulated, cervical emargination deep, cervical grooves deep, and reaching almost to postero-lateral margin; no eyes. *Ventral surface* (XV, b) like dorsal; festoons not so well marked; anus near posterior third; anal groove present, semi-circular; ano-marginal groove faint; no genital grooves; stigmatic pores in three pairs, one behind each coxa. *Legs* slender, light yellow; coxae I triangular; coxae II and III rectangular, each with posterior spine; tarsi thick, dorsal surface prominent. A few fine hairs on both surfaces of the body. *Rostrum* light coloured, elongate; base triangular on dorsal surface, wider than long; quadrangular on ventral surface; palpi elongate, article I short and narrow; article II twice as long as wide, constricted at base; article III nearly as long as article II; article IV very small and papilliform; mandibles like those of female; hypostome as in female.

Eggs.—Very small, 0.50 mm. long by 0.40 mm. wide, light brownish in colour.

Hosts.—Iguana (*Varanus niloticus*) in Transvaal, Natal, Cape Colony, and Senegal; *Varanus sp.* in German East Africa and Algeria; *Python sebai*; dog in South Africa. Both nymphs and adults are found on the above hosts.

Distribution.—German East Africa, Madagascar, Natal, Transvaal, Cape Colony, Senegal, Congo, Algeria.

This species is very common in the Transvaal on iguanas, snakes, and large lizards, but has never been bred out. Nymphs and larvae are also common on the same hosts as the adults.

APONOMMA LAEVE, var. CAPENSE. NEUMANN.

THE SNAKE TICK.

Aponomma laeve, Neumann, var. *capense*, Neumann (1901).

Plate XV, figures d, e, g, h, i.

Male.—*Body* short, oval in outline, wider behind, where it is widely rounded; length 3 mm., including rostrum; width 2 mm. *Shield* light yellowish brown in colour, often so thin as to show the internal organs in

the outline ; covers all of the dorsal surface ; smooth with no punctuations ; no marginal grooves ; no eyes ; no cervical grooves ; cervical emargination deep ; festoons very short and poorly defined ; dorsal porose areas just posterior of level of coxae IV, small, and widely separated. *Ventral surface* yellowish white, with alimentary canal sometimes showing through as white ; numerous fine punctuations and many short whitish hairs ; festoons much larger than on dorsal surface, and more sharply defined ; sexual orifice opposite coxae II ; sexual grooves very divergent behind coxae IV ; anus at the posterior quarter of the length ; anal groove semi-circular, opening in front ; ano-marginal groove very faint ; stigmatic plates large, sub-triangular, a narrow postero-lateral prolongation. *Rostrum* colour of shield, long and slender ; base almost triangular on the dorsal surface, sides rounded, rectangular on the ventral surface, wider than long ; hypostome spatulate, small denticles on the tip, then eight transverse rows, three teeth each on each half, the two outer teeth on each row very large and sharp, below these, and extending to the base, are indications of denticles, but represented only by crenulate creases : mandibles (XV, *h*) with inner apophysis of digit very thick and stout, recurved at the tip and bearing below the tip a paired or double transverse process with teeth projecting outward, outer apophysis with one large strong tooth bearing two very small teeth on its anterior edge ; palpi elongate, more slender than in *exornatum*, excavated on inner edge ; article I very short ; article II constricted at its base, and twice as long as article III ; article IV papilliform, and in a pit on the antero-ventral part of article III. *Legs* short, but not so thick as in *exornatum* ; coxae rather short, almost contiguous, each with a long sharp spine on the median part of the posterior edge (XV, *d*) ; tarsi long and slender, sharply attenuated at extremity, a single spur on the ventral surface.

Female.—*Body* in a short, wide oval ; convex on the dorsal surface ; unengorged 3 mm. long (without rostrum) by 2.5 mm. wide. *Shield* reddish mahogany brown, clear, cordiform, the lateral angles at the anterior third of the length, the two postero-lateral margins concave, posterior angle rounded ; cervical grooves lacking ; cervical emargination deep ; punctuations very small, superficial, and few in number, located mostly in the anterior angles. *Dorsal surface* reddish yellow, grooves very superficial ; eleven marginal posterior festoons, very short ; dorsal porose areas very small, immediately posterior of shield. *Ventral surface* of same colour ; a few scattered white hairs ; sexual orifice opposite the interval between coxae II and III ; anus rather posterior ; anal groove in a wide semi-circle ; ano-marginal groove short ; posterior margin festooned as on the upper surface, only more strongly marked, stigmatic plates large, pale, comma-shaped. *Rostrum* narrow, long, base with sides rounded, fitted into emargination of shield ; porose areas elliptical longitudinally, small and far apart ; digit of mandibles with inner apophysis rather anterior, transverse ; outer apophysis with three teeth progressively increasing ; hypostome wide, with three rows of teeth on each half, six to seven teeth in each row, many small denticles on tip, and below them the large teeth, then crenulate to base ; palpi narrow. *Legs* of medium length, thick hairs rare and short ; coxae large, narrow, dark coloured, two long sharp spines on the posterior margin of coxae I, a single long spine on median posterior margin of coxae II, III, and IV ; tarsi three times as long as wide, those of first pair longer, and swollen at level

of false articulation, the bosses of tarsi not pronounced ; a small terminal spur.

Nymph.—*Body* broadly oval ; widely rounded at both extremities ; almost as wide as long, unengorged 1 mm. (without rostrum), engorged 2.3 mm. long by 2 mm. wide (with rostrum) ; colour light yellowish, almost translucent. *Shield* (XV, g) heart shaped, as wide as long, broadly rounded at posterior angle, postero-lateral edges slightly concave, antero-lateral edges, colour light yellowish with reddish eye-like spot in each antero-lateral angle ; cervical emargination deep, no cervical grooves ; no punctuations. *Dorsal surface* with a median and two lateral grooves, all three long and straight ; festoons well marked. *Ventral surface* same colour as the dorsal ; anus at the posterior third ; coxal grooves widely divergent behind ; anal groove semi-circular, opening in front ; ano-marginal groove long and distinct ; festoons present ; stigmatic plates almost circular, slightly elongate on postero-lateral edge. *Rostrum* small, slender ; base nearly triangular on dorsal surface, rectangular ; ventral surface slightly wider than long ; hypostome with numerous small denticles at the tip, then two rows of three teeth each, followed by two series of teeth on each half, consisting of six teeth in each series ; mandibles (XV, i) with inner apophysis of digit slender, and bearing a lunate process near its tip, the extremities of which are sharp and extend outward, the outer apophysis bears four teeth, the two lower very large, the two anterior very small ; palpi elongate, excavated on inner edge ; article I very short and wide ; article II constricted at base, and twice as long as article III ; article IV as in male, only a little larger proportionately. *Legs* short and thick, light yellowish in colour ; tarsi I very long ; all tarsi gradually attenuated at their extremity ; no spurs present ; coxae (XV, e) rather elongate, coxae I with a short spine on its posterior median angle ; coxae II, III, and IV with a short blunt spine on the middle part of the posterior edge.

Larva.—*Body* short, nearly circular in outline, unengorged 0.8 mm. wide by 1 mm. long, including rostrum ; engorged 1.3 mm. long, including rostrum, by 1 mm. wide ; colour yellowish brown (almost colourless). *Shield* same colour as body, heart shape, posterior angle broad, surface finely reticulated, cervical grooves deep, concave outward, no marginal grooves, at each antero-lateral angle a light reddish eye-like spot. *Dorsal grooves* and festoons faintly marked. *Ventral surface* same colour as dorsal ; anus at posterior fourth of length ; anal groove semi-circular, other grooves only faintly marked ; three pairs of stigmatic plates, one behind each coxa. *Rostrum* similar to that of *exornatum* ; mandibles with inner apophysis bidentate, outer apophysis with four teeth ; hypostome spatulate ; several denticles at tip, then two rows on each half of three teeth each, followed by five or six rows of large teeth, two teeth on each half to a row ; palpi slender, article I short, articles II and III about equal in length. *Legs* very slender and light coloured ; coxae each with a sharp spine on their posterior margins.

Hosts.—Black snake (Cape Colony), Mamba (*Dendraspis angusticeps* (Transvaal), and other snakes. Both adults, nymphs, and larvae have been found on snakes.

Distribution.—Cape Colony (Adelaide), Transvaal, Mozambique.

APONOMMA LATUM. (KOCH.)

Amblyomma latum, Koch (1844, 1847).

Aponomma politum, Neumann (1899).

Amblyomma laeve, Neumann (1899).

Aponomma latum (Koch) (Neumann, 1901).

Male.—*Body* oval, flat, 5 mm. long (without rostrum), 4 mm. wide, ochreous yellow in all its parts. *Shield* covers all the dorsal surface, uni-colour, glabrous; cervical grooves short, concave; no lateral grooves; posterior festoons elongated, with separations deep and curved outward; a few punctuations, very fine, more sparsely scattered about the periphery of the shield; on each margin at the level of legs II, a smooth area, representing an obsolete eye. *Ventral surface* clothed with very short, translucent hairs; stigmatic plates comma-shaped. *Rostrum* 1.3 mm. long; hypostome with three rows of teeth on each half; first pair of coxae provided with two short, blunt spines; coxae III with a large dentate plate; the other coxae unarmed; tarsi short, with a bosse near their outer extremity; claws long, caruncle short.

Female.—As wide as long (2.7 mm.), but widest behind; when fully engorged it may become as much as 9 mm. long by 6.5 mm. wide; colour reddish brown. *Shield* reddish brown, uni-colour without spots, heart shaped, almost as wide as long, smooth and shining, punctuations very fine, almost invisible; cervical grooves reduced, only extremities present. *Dorsal surface* deep reddish yellow, a little lighter on the edges, and smooth, a little shining; usual grooves replaced by shallow depressions; posterior festoons rather prominent. *Ventral surface* lighter coloured than dorsal, a few short hairs and punctuations present. *Rostrum* reddish in colour; base rectangular, almost twice as wide as long; hypostome elongate, rounded at the tip, three rows of teeth on each half; palpi long, flat, narrow, hairs present; porose areas not very deep. *Legs* slender, of medium length; coxae like those of male, tarsi longer than those of male, and bosse less prominent.

Hosts.—Serpents, *Python molurus*.

Habitat.—East Indies, Durban.

This species I have never seen. The description is compiled from those given by Neumann.

GENUS NEUMANIELLA. (LAHILLE.)

Neumaniella, Lahille.

Body wider than long; narrow in front, and very wide behind; palpi elongate, but shorter than in *Aponomma*; no eyes; sexual grooves very short or entirely lacking; no anal groove.

This genus was established by Lahille on the species *Aponomma transversalis*, Lucas, a South African species. It is very closely related to *Aponomma*, and differs from it mainly in the shape of the body, wider than long, whereas the species of *Aponomma* are as long as wide, and by the very short sexual grooves on the ventral surface, or entire absence of them, and the entire absence of the anal groove. When Neumann described this type species (1899) he drew attention to the fact that it differed considerably from the typical *Aponomma*, and suggested that it might eventually be

proved to constitute a separate genus. It seems to me that the differences are quite sufficient for that, and I have therefore followed Lahille in retaining it.

There is only one species belonging to this genus in South Africa, *Neumaniella transversale*. I have never seen a specimen, but have followed Neumann in the following description:—

NEUMANIELLA TRANSVERSALE. (LUCAS.)

PYTHON TICK.

Ixodes transversalis, Lucas (1844, 1845).

Aponomma transversale, (Lucas) (Neumann, 1899).

Plate XVI, figures *n* (*a*, *b*, *c*, *d*).

Male.—*Body* flat, narrow in front, very wide behind, wider than long, 3 mm. wide by 2.75 mm. long (rostrum not included). *Shield* reddish brown, glabrous, smooth, without punctuations or with punctuations very fine and few in number; cervical grooves straight, parallel behind, then two large pits, and at the periphery five to seven short, radiating grooves; marginal grooves not very apparent, but marking off a light coloured marginal area, narrow in front, wide behind, where it is divided into eleven poorly defined festoons. *Ventral surface* reddish yellow, concave, with very short, scarcely visible hairs; sexual opening opposite second inter-coxal space; sexual grooves very short; anus near the posterior third of the length of the body; no anal groove; ano-marginal groove well marked; stigmatic plates nearly transverse, short comma shaped. *Rostrum* 1 mm. long, base large, a little wider than long, dorso-posterior angles fairly prominent; mandibles [*XVI*, *n* (*a*)] with inner apophysis bearing a process with two teeth, and with base elongate longitudinally, and nearly half as long as the apophysis; outer apophysis with four teeth, the posterior strongest, and the base of the apophysis narrowed to a point; hypostome [*XVI*, *n* (*c*)] wide, spatulate, emarginate at tip, which is furnished with a very large number of small denticles, extending over the anterior third of the hypostome; two rows of seven to eight large teeth in each row along each outer margin; palpi thick, third article equal in length to two-thirds of the length of the second article, both articles with a few hairs on their margins. *Legs* short, thick, chestnut brown in colour; coxae rather strong, a short spine in the centre of the posterior margin of each; tarsi thick; tarsi IV twice as long as wide, each tarsus provided with two small terminal spurs, followed by a similar spur near the distal third of the ventral margin on tarsi II, III and IV; tarsi I bears *Haller's organ* in the middle of its length, false articulation near the middle of the length in tarsi II, III and IV [*XVI*, *n* (*d*)]; short hairs on all of the articles.

Female.—*Body* swollen; very wide, ordinarily 1.5 mm. long by 2.5 mm. wide, but may reach a size of 6 mm. in length and 8 mm. in width; glabrous; reddish brown or dirty green in colour. *Shield* [*XVI*, *n* (*b*)] cordiform in outline, angles rounded, except the posterior angle, which is a little emarginate; lateral margin very convex; colour reddish brown; no hairs and no punctuations; cervical grooves deep, nearly straight, and pointed, reaching posterior margin, and dividing the surface into three parts, median of which is rectangular in outline, the laterals triangular, and

not more than half as wide as the median area. *Dorsal surface* glabrous, several radiating deep pits, of which one is median and posterior; eleven festoons not very apparent on the posterior edge. *Ventral surface* concave or swollen, glabrous; festoons very short on the posterior margin; sexual orifice wide, prominent, opposite the second inter-coxal space sexual grooves very divergent; anus near the posterior quarter; anal and ano-marginal grooves not present; stigmatic plates oval; elongated transversely. *Rostrum* 1 mm. or more in length, base short, nearly three times as wide as long; porose areas large, not very deep, well separated, not apparent in young females: mandibles with inner apophysis bearing a short, sub-globose process inserted at near anterior third of apophysis, and bearing two small teeth; outer apophysis large, with three or four terminal teeth followed by two large, almost equal teeth; hypostome and palpi similar to those of the male. *Legs* similar to those of the male.

Host.—Python (*Python sebai*). Found in the sockets of the eyes (Neumann).

Habitat.—South Africa.

GENUS RHIPICENTOR. NUTTALL and Warburton.

Rhipicentor, Nuttall and Warburton (1907).

Eyes present; base of rostrum wider than long, lateral angles prominent; palpi as wide or wider than long; stigmatic plates comma shaped; no ventral anal plates; coxae I divided into two stout teeth; coxae IV of male very much larger than coxae I, II and III, and bears in both male and female two very large spines on the posterior margin.

RHIPICENTOR VICINUS. NEUMANN.

THE HEDGEHOG TICK.

Rhipicentor vicinus, Neumann (1908).

Plate VII, figures f to i.

Male.—*Body* sub-oval, wider near the posterior, slightly constricted behind the eyes, 6 mm. long (rostrum included), 3.2 mm. wide near the posterior third. *Dorsal shield* slightly convex, shining, chestnut brown in colour, without spots, narrow margin of the abdomen showing beyond the shield in the posterior two thirds; cervical grooves deep and wide, spreading out widely; marginal grooves commencing behind the eyes, deep, rather close to the margin, terminating in a groove between the two last festoons; punctuations large, sub-equal, not very numerous, very distant from each other, arranged in lines near the lateral margins, one to two punctuations on each festoon; more numerous in front of the eyes; in front of the festoon a crescent shaped depression, marked by fine punctuations. *Eyes* flat, yellowish, marginal, three small punctuations forming a border on the inner side. *Ventral surface* (VII, f) reddish yellow, with a few very short hairs; anal groove semi-circular, open to the front, supported behind by a single ano-marginal groove which terminates at the median festoon; genital grooves diverging widely behind coxae IV; ventral festoons well marked; wider than long, no groove limiting them in front; no caudal prolongation; stigmatic plates of a medium size, comma shaped, with the prolongation extending postero-dorsally. *Rostrum* (VII, g) 0.92 mm. long (from the tip of the palpi to the point of the posterior angles); dorsal surface of the base twice as wide as long, lateral angles near the anterior

third, very sharp and projecting ; the posterior angles prominent but not spiniform, prolonged in front by a slight projection, which bounds a depression on the dorsal surface almost equal to a third of the width ; hypostome wide, slightly spatulate, six rows of strong teeth present ; palpi as wide as long, convex on their external edges ; the first article scarcely visible, the second nearly twice as wide as long, prolonged in a strong retrograde spine on its postero-ventral margin, and bearing a fringe of whitish hairs on the inner ventral margin ; the third article without ventral spines ; the fourth article small, and hidden in the pit of the third article. *Legs* strong ; coxae I as long as the dorsal surface of the rostrum, divided into two strong, sub-equal contiguous spines which form three-quarters of their length ; coxae II and III divided on their posterior margins into two flat, sharp spines, which are as wide as long ; coxae IV large, almost as wide as long, provided on their posterior margins with two long narrow sub-equal spines, well separated from each other, the inner one a little larger, not as long as the coxa ; article II of the first pair of legs provided near the distal extremity with a spine, dorsal, retrograde, flat, aliform and as wide as long ; articles III, IV and V short and thick ; tarsi small, sloping at the distal end, with a small spur and weak claws.

Female.—*Body* oval, 6 mm. long (rostrum included), 3 mm. wide, sides convex. *Shield* (VII, *h*) scarcely longer (2.5 mm.) than wide (2.3 mm.) irregularly oval, deep chestnut brown ; cervical grooves deep in front, prolonged almost to the posterior margin ; lateral grooves deep and wide each joining the corresponding cervical grooves in front and behind, and formed by punctuations in lines ; punctuations large, not very numerous, more numerous outside the lateral grooves, about a score in the median area ; a few very fine punctuations near the lateral margin ; eyes similar to those of the male ; situated slightly in front of the lateral angles, bordered on the inner margins by four large punctuations. *Dorsal surface* with a very few very short hairs ; two deep marginal grooves ; three longitudinal grooves, the median of which is confined to the posterior quarter, the other two are symmetrical, extending from the posterior margin, and widening out in front they join the postero-lateral margin of the shield ; the festoons are very distinct. *Ventral surface* has grooves well formed, punctuations fine, a very few short hairs ; stigmatic plates wide, sub-triangular (oval with an outer prolongation), whitish in colour. *Rostrum* (VII, *h*) 1.2 mm. long ; dorsal surface of base nearly three times as wide as long, half as wide as the dorsal shield ; lateral projecting angles near the middle of the length, the posterior angles wide, and not projecting, scarcely passing beyond the margin ; porose areas oval, nearly twice as long as wide, parallel, separated by a distance equal to their small diameter ; hypostome as in the male ; palpi more than twice as wide as long ; article II longer than wide, and longer than article III, prolonged in a short retrograde spine on its posterior ventral margin. *Legs* long, not so strong as those of the male ; coxae I as in the male, spines just as strong ; coxae II, III and IV with two short flat spines, diminishing in size from coxae II to IV, on the last of which they are small and widely separated (VII, *i*), article II of the first pair of legs, as in the male ; the other articles (tarsi included) larger and not so thick as in the male.

Hosts.—Hedgehog (*Erinaceus frontalis*, Bennett).

Habitat.—Pienaar's River and Pretoria, Transvaal.

The type specimens of this species were originally collected by Dr. Gough, of the Transvaal Museum, from hedgehogs taken near Pretoria in

November, 1907. I also took specimens from a hedgehog found near Pienaar's River a few weeks later.

This genus is an intermediate form between *Rhipicephalus* and *Dermacentor*. The palpi and general form would lead one to place it in the genus *Rhipicephalus*, but the size of the posterior coxae and the absence of anal plates in the male bring it closer to *Dermacentor*. Nuttall and Warburton in 1907 described a species *Rhipicentor bicornis*, from which this genus was erected; again, early in 1908, Neumann described the same species which he called *Rhipicephalus gladiger*, not knowing that it had been previously described. Upon examining the specimens of *vicinus*, which we forwarded to him for determination, he came to the conclusion that they would warrant the establishment of a new genus, and by a rare coincidence proposed the name *Rhipicentor*. Before publication, however, he found that he had been anticipated by Nuttall and Warburton.

There are only two species in the genus, *bicornis* and *vicinus*, the latter of which is found in the Transvaal. The co-types of *vicinus* are deposited in the Transvaal Museum, Pretoria.

GENUS DERMACENTOR. KOCH.

Ixodes (ex p.), Latreille (1795).

Dermacentor, Koch (1844).

Pseudixodes, Haller (1882).

Dermacentor, Koch (Neumann, 1897).

Eyes present, base of rostrum wider than long, rectangular on the dorsal surface; palpi short and thick; stigmatic plates short and comma shaped. Ventral surface of male without shields, similar to that of female. Coxae I bidentate in both sexes; coxae IV in the male very much larger than the others. *Dorsal shield* usually ornamented with various designs.

Only one species of *Dermacentor* has been reported from South Africa, *D. rhinocerotus*. I have never seen specimens of this species, but the description as given by Neumann follows:—

DERMACENTOR RHINOCEROTIS. (DE GEER).

THE RHINOCEROS TICK.

Acarus rhinocerotis, De Geer (1778).

Ixodes rhinocerinus, Denny (1843).

Ixodes rhinocerotis, Gervais (1844).

Amblyomma rhinocerotis, Koch (1844).

Amblyomma rhinocerinus, Koch (1844).

Dermacentor rhinocerotis, Gerstäcker (1873).

Dermacentor rhinocerotis (De Geer) (Neumann, 1897).

Plate XVI, figures o, p (a, b).

Male.—*Body* oval, wider behind, a little restricted at the level of the eyes. Dorsal surface (XVI, o) convex, 7 to 8 mm. long by 5 to 5.5 mm. wide; ground colour of shield clear brick red on specimens from Natal, ochre yellow or greenish yellow on those from Moçambique, spots of reddish

brown, punctuations large, not very numerous ; the dark spots limit, in front a surface in the shape of a curvilinear triangle, reddish yellow, which resembles a shield of a female, bordered by a dark colour, except on the transverse margin of the rostral emargination ; from the angles of this emargination start two short, narrow, interrupted, curved lines which limit behind a small, irregular, clear area ; eyes yellow marginal, in the dark coloured margin opposite coxae II ; eleven posterior festoons penultimate, and the ones next the median dark coloured, the other seven light coloured on all, or nearly all, of their extent ; near the margin in front and on each side two successive light coloured spots, which continue the series of the festoons ; the remainder of the shields show six light coloured spots, paired, symmetrical ; two small posterior, two large ones in front of these, two small ones, one on each side of the posterior extremities of the anterior shield-like spot ; these spots are separated by brown lines as follows :—A median and two successive transverse lines, the anterior concave behind, the posterior straight ; the light spots are sometimes of a more reddish yellow, the light coloured anterior spot is sometimes divided into two by a deep, transverse, irregular sinuous line, resulting from the extension and the anastomosing of the two curved lines which mark off the areas of the anterior angles ; sometimes a brown spot fusiform and median cuts this transverse line ; the two small anterior light spots of the posterior half join in front with the anterior shield-like spot, of which they seem to be appendages ; and punctuations are deeper. *Ventral surface* brick red or reddish brown ; sexual orifice opposite coxae II ; sexual grooves very close on account of the great size of the coxae, parallel at first, nearest together opposite coxae IV, then sharply diverging and ending near the anterior edge of the antepenultimate festoon ; anal disc brown, very prolonged backward ; stigmatic plates large, whitish. *Rostrum* 1.1 mm. long, dorsal base wider than long, posterior margin concave ; mandibles [*XVI, p (b)*] 1.75 mm. long, digit with inner apophysis elongate transversely, with two short points, outer apophysis with two teeth, one small, terminal, a little sub-ventral, the other very strong ; hypostome long, a little spatulate, denticles in front very small and numerous, behind them six longitudinal rows of teeth of about eleven teeth to each row, followed by four rows of squamiform teeth, the outer prolonged backward ; palpi a little longer than the hypostome, wide on their dorsal surface, narrow on the ventral ; article I short, ring-like ; article II longer than wide, dorsal surface of the same colour as the shield and prolonged behind on the first article ; article III shorter than article II, almost square ; both provided with hair on their margins and dorsal surface ; article IV small, embedded in a terminal excavation of article III. *Legs* strong, reddish brown, lighter on their dorsal surfaces ; coxae regularly increasing in size from first to fourth pair, which last are very large, very close to the median line ; all coxae sprinkled with whitish hairs ; coxae I divided into two strong teeth, the outer more slender than the inner ; coxae II and III with a strong tooth near the posterior external angle ; coxae IV with two teeth, the outer of which is stronger ; articles IV, V, and especially VI, of legs with strong teeth on their lower margins ; a light coloured spot on the dorsal side of the distal end of article II of leg I, the other articles, except the tarsi, of all the legs ringed with ferruginous red on their distal ends, and with thin whitish hairs ; tarsi relatively elongate, the false articulation very close to the distal end of tarsi I, near the middle in the others ; a strong parallel spur, caruncle short, reaching scarcely the third of the length of the claws.

Female.—*Body* short, oval, wider behind, 7 to 8 mm. long by 4 to 5 mm. wide ; blackish brown, with the exception of the dorsal shield ; the rostrum and the legs reddish brown. *Dorsal shield* [XVI, *p* (*a*)] very large, reaching almost to the middle of the length of the body, a short oval, the posterior margin emarginate by two shallow sinuses, which divide into three not very prominent lobes, of which the median is twice the lateral ones in size ; anterior emargination for the insertion of the rostrum limited by two wide blunt points ; cervical grooves very short, transformed into two deep pits ; punctuations large, scattered in the anterior half, very fine and numerous on all the surface, which is rather shiny ; colour clear brick red on individuals from Natal, clear ochre yellow on female from Zanzibar, with two reddish brown spots occupying and bordering the two anterior cervical pits, two other irregular spots about the eyes (which are small and clear yellow) and on the lateral margin which precedes them two other irregular spots behind those of the cervical grooves. *Dorsal surface* of abdomen with a marginal groove very far from the margin, limiting more or less clearly the inner extremity of the eleven posterior festoons ; irregular grooves, one transverse, the other longitudinal, of which three are constant, a median and two close to it ; striations of integument very apparent, hairs abundant, whitish in the marginal grooves, yellow, purplish red and blood red in the posterior third, where they form two wide lateral clusters, some on the festoons. *Ventral surface* with large, whitish, scattered hairs ; sexual grooves rather separate, rendered deeper by the integumental prominences which come from the interval between the coxae, diverging at the level of coxae IV ; anus rather anterior ; ano-marginal groove relatively long ; stigmatic plates greyish white, short, comma shaped. *Rostrum* with dorsal base twice as wide as long ; its posterior angles prolonged in short points ; colour of the shield in its middle ; porose areas deep, separate, a little oval and diverging, ventral surface wide, semi-circular ; mandibles long [XVI, *p* (*b*)] ; digit with inner apophysis with three points, the median longer ; outer apophysis with three successive teeth, the terminal one a little sub-ventral, the basilar one strong and a little bent downwards ; hypostome and palpi like those of the male. *Legs* like those of the male, except that the coxae are relatively feeble, increasing a little from first to fourth pair ; the inner tooth of coxae IV is stronger than the outer.

Hosts.—Rhinceros (South Africa) and some other mammals, usually found on the genitals.

Habitat.—Mozambique, Durban, Cape Colony, Zanzibar, Zambesi.

GENUS HAEMAPHYSALIS. KOCH.

Rhipistoma, Koch (1844).

Gonixodes, Duges (1888).

Opistodon, Canestrini (1897).

Haemaphysalis, Koch (Neumann, 1897).

No eyes, base of rostrum rectangular, elongated transversely twice as wide as long. Palpi conical, the second article forming a strong, conical, lateral, and basilar projection. Stigmatic plates circular or short comma shaped. Ventral surface of male without anal plates ; coxae I not bifid ; coxae IV in the male of normal dimensions. Integument of uniform brownish colour.

Only one species has been reported from South Africa.

HAEMAPHYSALIS LEACHI. AUDOUIN.

THE DOG TICK.

Ixodes leachii, Audouin (1827).

Rhipistoma leachi, Koch (1844).

Rhipistoma ellipticum, Koch (1844).

Rhipicephalus ellipticus, Koch (1847).

Rhipidostoma leachi, Karsch (1879).

Haemaphysalis leachi (Audouin) (Neumann, 1897).

Plate XVI, figures a to m.

Male.—*Body* elongate, oval, a little convex on the dorsal surface; length 3 mm., width 1.5 mm. behind the stigmata, narrower in front; colour light reddish brown. *Shield* (*XVI, l*) covers all the dorsal surface; when fully engorged sometimes a narrow line of the body is seen at its lateral margins; cervical grooves reach to level of coxae III, deep at first, then wide and shallow; a deep marginal groove, which extends far enough caudad to form the exterior margin of the three extreme caudal festoons on each side; eleven festoons present, but not always distinct on the lateral margins; punctuations numerous, fine, equal, evenly distributed over the surface. *Ventral surface* lighter coloured, yellowish, a few fine hairs and a few punctures; sexual orifice relatively wide opposite anterior edge of coxae II, an elongate plate, posterior of it; sexual grooves not very deep, diverging; anus at posterior quarter of length, large, circular; no anal plates present; anal groove somewhat V shaped, ano-marginal groove short; stigmatic plates short, comma shaped, with the lateral point well formed. *Rostrum* (*XVI, a, b*) with base rectangular, wider than long; posterior angles of dorsal surface of base prolonged backward in blunt points; mandibles (*XVI, c*) short, digit with inner apophysis thick and stout, anterior end bent in a blunt tooth, a transverse process near anterior end; outer apophysis short, stout, bearing three teeth, two terminal ones very small; palpi longer than hypostome, triangular, article I very short and narrow, hidden under article II; article II with outer angle very much prolonged, lateral and sharp, projecting beyond the base of the rostrum by half its width, bearing two retrograde points on its posterior edge, one dorsal and one ventral, provided with eight simple hairs on its ventro-median margin; article III with three simple hairs on the posterior part of the margin; its ventral surface prolonged backward in a strong, recurved tooth; article IV cylindro-conical, transverse, relatively long, terminated by seven or eight hairs; short hairs on the two surfaces of the palpi, hypostome short and wide with anterior denticles numerous; on each half are four rows of teeth, with ten or twelve in each row; teeth strong, those in each transverse row almost equal; the anterior ones a little smaller. *Legs* of medium length, same colour as body; coxae (*XVI, d*) wide and nearly contiguous, a little hairy, with a wide blunt spine near postero-median angle; tarsi relatively short; tarsi I with pseudo-articulation at distal quarter of length; all tarsi with a small terminal spur, caruncle

almost as long as the claws ; a double row of hairs on the ventral margin of the four last articles.

Female (unengorged).—*Body* flattened, oval, wider behind, 3.5 mm. long by 1.6 mm. wide ; colour usually light reddish brown, sometimes whitish. *Rostrum* (XVI, e, f), legs and shield deeper coloured. *Dorsal shield* (XVI, m) elongate, oval sides convex, almost equal to half the length of the body ; punctuations equal, deep and regularly distributed over the whole surface ; no eyes present ; cervical grooves deep, then shallow, concavity outward, extending almost two-thirds of length of shield ; no marginal grooves present ; cervical emargination deep, rectangular. *Dorsal surface* with numerous punctuations and a few very short hairs, with a prominent marginal groove, forming the inner margin of the three outer festoons on each side ; festoons almost square ; two short anterior grooves ; three long posterior grooves. *Ventral surface* with punctures and fine whitish hairs as on dorsal surface ; sexual orifice relatively narrow, transverse with a surrounding ring, elongated from front to back, situated opposite coxae II ; sexual grooves not very deep, concave and diverging from their origin ; anal groove somewhat V shaped ; ano-marginal groove larger than in male, equal to about a quarter of the length of the body ; posterior festoons very distinct ; anus large, circular, five spines on each valve and near the circumference ; stigmatic plates whitish, short, comma shaped, almost circular. *Rostrum* slightly shorter than that of male ; base a little shorter than that of the male, and posterior angles of dorsal base not quite so large ; porose areas well separated, rounded ; mandibles (XVI, g) longer, inner apophysis at digit not so thick as in male, and transverse process lunate in shape, opening outward ; outer apophysis with six teeth, two basal ones large, four anterior ones small and arranged on a separate articulated apophysis ; hypostome as in male, only there may be five rows of teeth on each half instead of four ; palpi longer and narrower than in those of male, no retrograde tooth on the ventral side of article II. *Legs* as in male, except the tarsi are longer, and the terminal spine is not so strong ; coxae are not so wide, and the spines are not so strong as in the male ; caruncle reaches only three quarters of the length of the claws.

When *engorged*, the body is ovoid, of a bluish or greyish brown colour, and often attains a length of 11 mm. by 7.5 mm. in width. The grooves of the unengorged female disappear, and in their place we have faintly indicated dotted lines ; on the dorsal surface two anterior, short, and diverging grooves, and three long posterior grooves, the median of which is straight, while the laterals have their convexity inward ; on the ventral surface are the genital grooves, ano-marginal grooves, and two very short grooves on each side of the ano-marginal groove ; on account of the swelling of the body the genital opening becomes shifted anteriorly to a position opposite coxae I.

Nymph (unengorged).—*Body* elongate, elliptical ; colour dark chestnut brown ; length 1.5 mm., width 1 mm. *Dorsal surface* bears a marginal furrow as in the female ; festoons well marked, three prominent dorsal grooves, deep and of equal length. *Shield* dark brown ; pentagonal in shape ; as wide as long ; widely rounded behind ; punctuations fine and evenly distributed ; no eyes ; cervical grooves not very deep, straight and extending to posterior margin. *Ventral surface* lighter in colour ; festoons

prominent ; anus at posterior third of length of body, four spines on each valve, three on circumference and one near opening ; anal groove V shape ; no genital pore ; genital grooves beginning opposite coxae III, diverging and extending to penultimate festoonal grooves ; stigmatic plates slightly elongate, transversely, very far caudad of coxae IV ; apparently a pair of stigmatic openings opposite first inter-coxal space, near lateral margin. *Rostrum* (XVI, *h, i*) dorsal base narrow, twice as wide as long ; posterior points not prominent ; article I of palpi concealed ; article II wider than long, projecting sharply laterally backward, projecting tooth on dorsal surface blunt and wide, on ventral side sharper and longer ; article III conicle and pointed at tips ; article IV papilliform, in a pit on the ventral side of article III ; hypostome spatulate, with two rows of teeth on each half ; mandibles (XVI, *k*), with inner apophysis lunulate, outer apophysis with two large teeth surmounted by two small teeth on a separate articulation. *Legs* slender ; coxae wide ; rectangular ; a very large blunt spine on posterior edge of coxae I, a very faint spine on coxae II, III, and IV ; tarsi elongate, no terminal spur.

Larva (unengorged).—*Body* broadly ovate, widely rounded behind, length 0.5 mm. ; width 0.3 mm ; colour light yellowish ; caudal festoons well marked. *Dorsal shield* wider than long, covers anterior third of body ; cervical grooves faint ; punctuations fine and evenly distributed ; no eyes. *Rostrum* with base narrow, wider than long ; posterior angles not prominent ; palpi as wide as long ; article I concealed, article II as in nymph ; articles III and IV as in nymph ; hypostome as in nymph ; anus near posterior margin. *Ventral surface* with stigmatic openings as follows :—One pair behind coxae I, another behind coxae II, and a third behind coxae III. *Legs* stout ; coxae rectangular, contiguous short tooth on coxae I ; tarsi slender, no terminal spur.

Eggs of small size ; light greyish in colour ; elliptical in outline, surface smooth and shining ; about 0.5 mm. long by 0.3 mm wide.

Hosts.—Dog, cat, ox, leopard, lion, genette, civette (*Felis pardius*), hedgehog (*Erinaceus frontalis* in Transvaal), jackal (*Felis tigris*), carnivora in general, and in New South Wales it has been taken on horses and cattle. At Pretoria several nymphs were taken from the field rat, *Avicanthus pumillio*, and one nymph from a tortoise.

Habitat.—Egypt, Eastern Ethiopia, Abyssinia, Mahal, Korz Mountains, Algeria, Sierra Leone, French Congo, Congo, Cameroon Mountains, Cape Colony, Orange River Colony, Transvaal, Mozambique, German East Africa, New South Wales (probably a variety).

This is the commonest tick found on the dog in South Africa. Lounsbury says it is confined to the grass veld districts and the coast veld of Cape Colony, but I have found it in nearly every part of the Transvaal, in both grass veld, bush veld, and low veld. It attacks nearly all carnivora, but rarely any other group of mammals, being found only very rarely on cattle, even where most abundant. It transmits the distemper or malignant jaundice of dogs.

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ANIMALS WHICH ACT AS HOSTS FOR SOUTH AFRICAN TICKS.

I.—MAN.

Argas persicus.
 „ *vespertilionis.*
Ornithodoros savignyi.
 „ „ *caecus.*
 „ „ *pavimentosus.*
 „ *talaje capensis.*
Hyalomma aegyptium.
 „ „ *impressum.*
Ixodes pilosus.
Rhipicephalus appendiculatus.
Amblyomma hebraeum.

II.—DOMESTIC ANIMALS.

CATTLE.—*Ixodes pilosus.*

Ornithodoros savignyi.
 „ „ *caecus.*
 „ „ *pavimentosus.*
Hyalomma aegyptium.
 „ „ *impressum.*
Rhipicephalus sanguineus.
 „ *punctatissimus.*
 „ *evertsi.*
 „ *oculatus.*
 „ *capensis.*
 „ *appendiculatus.*
 „ *bursa.*
 „ *simus.*
 „ *duttoni.*
Margaropus annulatus decoloratus.
 „ „ *australis.*
Amblyomma hebraeum.
 „ „ *eburneum.*
 „ *marmoreum* (larvæ and nymphs).
Haemaphysalis leachi.

HORSE.—*Ixodes pilosus*

Hyalomma aegyptium.
 „ „ *impressum.*
Margaropus annulatus decoloratus.
 „ „ *australis.*
 „ *lounsburyi.*
Rhipicephalus sanguineus.
 „ *capensis.*
 „ *appendiculatus.*
 „ *bursa.*
 „ *simus.*
 „ *evertsi.*
 „ *lunulatus.*
Amblyomma hebraeum.
 „ *variegatum.*

Ass.—*Hyalomma aegyptium.*

„ „ *impressum.*
Margaropus annulatus decoloratus.
Rhipicephalus evertsi.
 „ *bursa.*
Amblyomma hebraeum.

MULE.—*Ixodes pilosus.*

Hyalomma aegyptium.
 „ „ *impressum.*
Rhipicephalus evertsi.
 „ *appendiculatus.*
Amblyomma hebraeum.
 „ *variegatum.*

SHEEP.—*Ornithodoros savignyi*.

- " " *caecus*.
 " " *pavimentosus*.
Ixodes pilosus.
 " *rubicundus*.
Hyalomma aegyptium.
 " " *impressum*.
Rhipicephalus sanguineus.
 " *appendiculatus*.
 " *bursa*.
 " *evertsi*.
 " *simus*.
Margaropus annulatus decoloratus.
Amblyomma hebraeum.
 " *variegatum*.

GOAT.—*Ornithodoros savignyi*.

- " " *caecus*.
Ixodes pilosus.
Hyalomma aegyptium impressum.
Margaropus annulatus decoloratus.
Rhipicephalus capensis.
 " *appendiculatus*.
 " *simus*.
Amblyomma hebraeum.
 " *variegatum*.
 " *marmoreum* (larvæ and nymphs).

FIG.—*Ixodes pilosus*.DOMESTIC DOG.—*Ixodes pilosus*.

- " " *howardi*.
Ornithodoros savignyi caecus.
Hyalomma aegyptium.
 " " *impressum*.
Margaropus annulatus decoloratus.
Rhipicephalus sanguineus.
 " *bursa*.
 " *evertsi*.
 " *punctatissimus*.
 " *appendiculatus*.
 " *simus*.
 " *capensis*.
 " *lunulatus*.
Amblyomma hebraeum.
Aponomma exornatum.
Haemaphysalis leachi.

CAT.—*Ixodes pilosus*.

- " " *howardi*.
Rhipicephalus sanguineus.
Hyalomma aegyptium.
Haemaphysalis leachi.

FOWLS.—*Argas persicus*.

- " *vespertilionis* (probably).
 " *transgariëpinus* (probably).
Ornithodoros savignyi.
 " " *caecus*.
 " " *pavimentosus* (not very readily).
 " *talaje capensis*.
Hyalomma aegyptium impressum (larvæ and nymphs).
Amblyomma hebraeum.

DUCKS, GEESE, TURKEYS, PIGEONS, CANARIES.—

Argas persicus.

Probably all those mentioned under Fowls.

III.—WILD ANIMALS.

CARNIVORA.

LION (*Felis leo*).—

Haemaphysalis leachi.
Rhipicephalus sanguineus.
Amblyomma hebraeum eburneum.
Rhipicephalus simus.

LEOPARD (*Felis pardus*).—

Haemaphysalis leachi.
Ixodes pilosus.

BLACK-FOOTED WILD CAT (*Felis nigripes*).—

Haemaphysalis leachi.

CIVETTE (*Viverra civetta*).—

Haemaphysalis leachi.

GENET (*Genetta felina* ?).—

Rhipicephalus sanguineus.
Haemaphysalis leachi.

MEERKAT (*Cynictis penicillata*).—

Haemaphysalis leachi.

CAPE HUNTING DOG (*Lycan pictus*).—

Amblyomma hebraeum.
Rhipicephalus simus.
 „ *nitens*.

DELANDES FOX (*Otocyon megalotis*).—

Rhipicephalus sanguineus.

JACKAL (*Canis sp.*).—

Rhipicephalus simus.
Haemaphysalis leachi.

UNGULATA.

BUSHBUCK (*Tragelaphus scriptus*).—

Ixodes pilosus (C.C.)

WATERBUCK (*Cobus ellipsiprymnus*).—

Rhipicephalus sanguineus.

REED BUCK (*Cervicapra arundinum*).—

Rhipicephalus evertsi.
Hyalomma aegyptium.

ANTELOPES of various species—

Hyalomma aegyptium.
Amblyomma hebraeum eburneum.
Rhipicephalus evertsi.
 „ *appendiculatus*.

CAPE BUFFALO (*Bos caffer*).—

Amblyomma hebraeum.
Rhipicephalus appendiculatus.

GIRAFFE (*Giraffa capensis*).—

Amblyomma hebraeum.
Hyalomma aegyptium impressum.
Rhipicephalus evertsi.

HIPPOPOTAMUS (*Hippopotamus amphibius*).—

Amblyomma hippopotamense.

RHINOCEROS (*Rhinoceros sp.*).—

Amblyomma hebraeum.
 „ *marmoreum*.
 „ *crenatum*.
Dermacentor rhinocerotis.

BUSH PIG (*Potamochoerus choeropotamus*)—*Hyalomma aegyptium*.*Rhipicephalus simus*.ELEPHANT (*Elephas africanus*)—*Amblyomma hebraeum*.ZEBRA (*Equus sp.*)—*Amblyomma variegatum*.

RHODENTIA.

STRIPED MOUSE (*Avicantis pumilio*)—*Haemaphysalis leachi* (nymph).*Rhipicephalus sanguineus* (?) (nymph).CAPE HARE (*Lepus capensis*)—*Hyalomma aegyptium impressum* (all stages, but especially larvæ and nymphs).*Rhipicephalus sanguineus*.,, *appendiculatus*.,, *evertsi*.

CHIROPTERA.

BAT (*Rhinolophus auror*)—*Ixodes pilosus howardi*.BAT (*Miniopterus schreibersi*)—*Argas vespertilionis* (Pretoria).

INSECTIVORA.

HEDGEHOG (*Erinaceus frontalis*).*Ixodes pilosus howardi*.*Rhipicephalus sanguineus*.,, *bursa*.,, *simus*.,, *lunulatus*.*Rhipicephalus vicinus*.*Haemaphysalis leachi*.

AVES.

OSTRICH (*Struthio australis*)—*Argas persicus*.*Amblyomma hebraeum*.*Hyalomma aegyptium impressum* (all stages).SECRETARY BIRD (*Serpentarius secretarius*)—*Argas persicus*.OWL (*Strix flammea*)—*Rhipicephalus lunulatus*.PENGUIN (*Spheniscus demersus*)—*Ornithodoros talaje capensis*.QUAIL (*Coturnix capensis*)—*Amblyomma marmoreum* (larvæ).LARK, THICK-BILLED (*Calendula crassirostris*)—*Hyalomma aegyptium impressum* (nymphs).KORHAAN (*Otis sp.*)—*Hyalomma aegyptium impressum* (nymphs).RINGED PIGEON (*Turtur semitorquatus*)

REPTILIA.

IGUANA (*Varanus niloticus*)—*Aponomma exornatum*.*Amblyomma hebraeum eburneum* (Zanzibar).

LIZARD (*Varanus sp.*)—

Aponomma exornatum.

LIZARD (Species unknown)—

Amblyomma marmoreum (larvæ).

MAMBA (*Dendraspis angusticeps*)—

Aponomma laeve capensis.

PYTHON (*Python sebae*).

Aponomma exornatum.

Neumaniella transversale.

SNAKES (Species unknown)—

Aponomma laeve capenses.

Aponomma latum.

Amblyomma marmoreum.

TORTOISE (Species unknown)—

Amblyomma marmoreum.

„ *sylvaticum* (C.C.)

RELATION OF SOUTH AFRICAN TICKS TO DISEASE.

DISEASE.	HOST.	ORGANISM CAUSING DISEASE.	TRANSMITTED BY.
Redwater Texas Fever Bovine Piropiasmosis	Cattle	<i>Piroplasma bigeminum</i>	<i>Margaropus annulatus decoloratus</i> <i>M. annulatus australis.</i>
East Coast Fever Rhodesian Redwater	Cattle	<i>Piroplasma parvum</i>	<i>Rhipicephalus appendiculatus</i> „ <i>capensis</i> „ <i>evertsi</i> „ <i>simus</i> „ <i>nitens</i>
Distemper Malignant Jaundice Biliary Fever of Dog Canine Piropiasmosis	Dog	<i>Piroplasma canis</i>	<i>Haemaphysalis leachi</i>
Biliary Fever Equine Piropiasmosis	Horse Mule Donkey	<i>Piroplasma equi</i>	<i>Rhipicephalus evertsi</i>
Heartwater	Sheep Goats Cattle	Unknown	<i>Amblyomma hebraeum</i>
Spirillosis	Cattle	<i>Spirochaeta theileri</i>	<i>M. annulatus decoloratus</i>
Human Tick Fever	Man	<i>Spirochaeta duttoni</i>	<i>Ornithodoros savignyi caecus</i>

A NEW SPECIES OF TICK FROM THE TRANSVAAL.

By Professor L. G. NEUMANN, of Toulouse.

RHIPICENTOR VICINUS, *n. sp.*

Male.—*Body* sub-oval, wider near the posterior third, slightly constricted behind the eyes, 6 mm. long (rostrum included), 3.2 mm. wide near the posterior third. *Dorsal shield* slightly convex, shining, chestnut brown in colour, without spots, a narrow margin of the abdomen showing beyond the shield, in the posterior two thirds; cervical grooves deep and wide, spreading out widely, marginal groove commencing behind the eyes, deep, rather close to the margin, terminating in the groove between the two last festoons; punctuations large, sub-equal, not very numerous, very distant from each other, arranged in lines near the lateral margins, one to two punctuations on each festoon; more numerous in front of the eyes; in front of the festoon a crescent-shaped depression, marked by fine punctuations. Eyes flat, yellowish, marginal, three small punctuations forming a border on the inner side. *Ventral surface* reddish yellow, with a few very short hairs. *Anal groove* semi-circular, opening to the front, supported behind by a single ano-marginal groove which terminates at the median festoon; genital grooves diverging widely behind coxae IV; ventral festoons well marked, wider than long, no groove limiting them in front. No caudal prolongation. Peritremes of a medium size, comma shaped, with the prolongation extending postero-dorsally. *Rostrum* 0.92 mm. long (from the tip of the palpi to the point of the posterior angles). Dorsal surface of the base twice as wide as long, lateral angles near the anterior third, very sharp and projecting, the posterior angles prominent but not spiniform, prolonged in front by a slight projection, which bounds a depression on the dorsal surface almost equal to a third of the width. *Hypostome* wide, slightly spatulate, six rows of strong teeth present. Palpi as wide as long, convex on their external edges; the first article scarcely visible, the second nearly twice as wide as long, prolonged in a strong, retrograde spine on its postero-ventral margin, and bearing a fringe of whitish hairs on the inner ventral margin; the third article without ventral spines; the fourth article small and hidden in the pit of the third article. *Legs* strong. Coxae I as long as the dorsal surface of the rostrum, divided into two strong, sub-equal contiguous spines which form three-quarters of their length; coxae II and III divided on their posterior margins into two flat, sharp spines, which are as wide as long; coxae IV large, almost as wide as long, provided on their posterior margins with two long, narrow sub-equal spines, well separated from each other, the inner one a little larger, not as long as the coxa. Second article of the first pair of legs provided near the distal extremity with a spine, dorsal, retrograde, flat, aliform, and as wide as long. The third, fourth, and fifth articles short and thick, but more slender than those of *R. bicornis*. Tarsi small, sloping at the distal end, with a small spur and weak claws.

Female.—*Body* oval, 6 mm. long (rostrum included), 3 mm. wide, sides convex. *Shield* scarcely longer (2.5 mm.) than wide (2.3 mm.), irregularly oval, deep chestnut brown; cervical grooves deep in front, prolonged almost to the posterior margin; lateral grooves deep and wide, each joining the corresponding cervical grooves in front and behind, and formed by punctuations in lines; punctuations large, not very numerous, more numerous outside of the lateral grooves, about a score in the median area; a few very fine punctuations near the lateral margins. Eyes similar to those of the male, situated slightly in front of the lateral angles, bordered on the inner margin by four large punctuations. *Dorsal surface* with a few very short hairs; two deep marginal grooves; three longitudinal grooves, the median of which is confined to the posterior quarter, the other two are symmetrical, extending from the posterior margin, and widening out in front they join the postero-lateral margin of the shield; the festoons are very distinct. The *ventral surface* has the grooves well formed, punctuations fine; a very few short hairs. Peritremes wide, sub-triangular (oval with an outer prolongation), whitish in colour. *Rostrum* 1.2 mm. long. Dorsal surface of base nearly three times as wide as long, half as wide as the dorsal shield, the lateral projecting angles near the middle of the length, the posterior angles wide, and not projecting, scarcely passing beyond the margin; porose areas oval, nearly twice as long as wide, parallel, separated by a distance equal to their small diameter. *Hypostome* as in the male. Palpi more than twice as long as wide; the second article longer than wide, and longer than the third article, prolonged in a short retrograde spine on its posterior ventral margin. *Legs* long, not so strong as those of the male. Coxae I as in the male, spines just as strong; coxae II, III, and IV with two short flat spines, diminishing in size from coxae II to IV, on the last of which they are small and widely separated; second article of the first pair of legs as in the male. The other articles (tarsi included) longer and not so thick as in the male.

Described from two males and two females collected at Pretoria on *Erinaceus frontalis*, Bennett, by C. W. Howard.

OBSERVATIONS.

I recently described,* under the name of *Rhipicephalus gladiger*, a species which has many characters analogous to this. I remarked then that the form and size of coxae IV of the male placed it near to *Dermacentor*; the anal shields are so slightly chitinized that one could consider them as lacking, a fact which increases the resemblance to the male *Dermacentor*. It seems that, as in that genus, the chitinous sexual organs are concentrated in coxae IV, instead of in the posterior part of the ventral surface. But the form of the rostrum, especially in the female, made me place the species in the genus *Rhipicephalus*.

In the early part of December, 1907, I received from Mr. C. W. Howard the specimens which are the types of *Rhipicentor vicinus*. In this species one cannot deny the absence of anal shields in the male, and, as Mr. Howard remarked to me, it ought to have some

*L. G. Neumann. Notes sur les Ixodidés, VI. Archives de Parasitologie, vol XII, 1908, p. 8.

connection with a species of *Dermacentor*. A second examination of *Rhipicephalus gladiger* brought me definitely to the conclusion that the anal shields were absent. *Rhipicephalus* is, therefore, no more in question. It is apparently an intermediate form between *Rhipicephalus* and *Dermacentor*. On the 21st of December I wrote to Mr. Howard that I intended to reunite the two species in a new genus which I proposed to call *Rhipicentor*.

It seems that the same thing occurred to Messrs. Nuttall and Warburton, for, by a rare coincidence, it is the same name chosen by them in a recent work* in which they describe, under the name of *Rhipicentor bicornis*, the species which I called *Rhipicephalus gladiger*. At the same time they gave the characters of the new genus which they establish in that paper. The publication of this work of Nuttall and Warburton having preceded my "Notes VI," it is evident that *Rhipicentor bicornis* must have the preference over *Rhipicentor gladiger*.

A comparison of the two species of the new genus show the following principal differences:—

Rhipicentor bicornis.

Male.—Base of rostrum, with posterior angles prolonged into a spine. Coxae IV with spines unequal, the inner one almost double the outer one.

Female.—Dorsal shield scarcely longer than wide. Palpi short. Coxae IV with spines longer than wide.

Rhipicentor vicinus.

Male.—Base of rostrum, with posterior angles simply projecting. Coxae IV with spines almost equal.

Female.—Dorsal shield scarcely longer than wide. Palpi long. Coxae IV with spines as wide as long.

* G. H. F. Nuttall and C. Warburton. On a new genus of Ixodoidea, together with a description of eleven new species of ticks. Proc. of the Cambridge Philosophical Society, vol. XIV, 1907, p. 398.

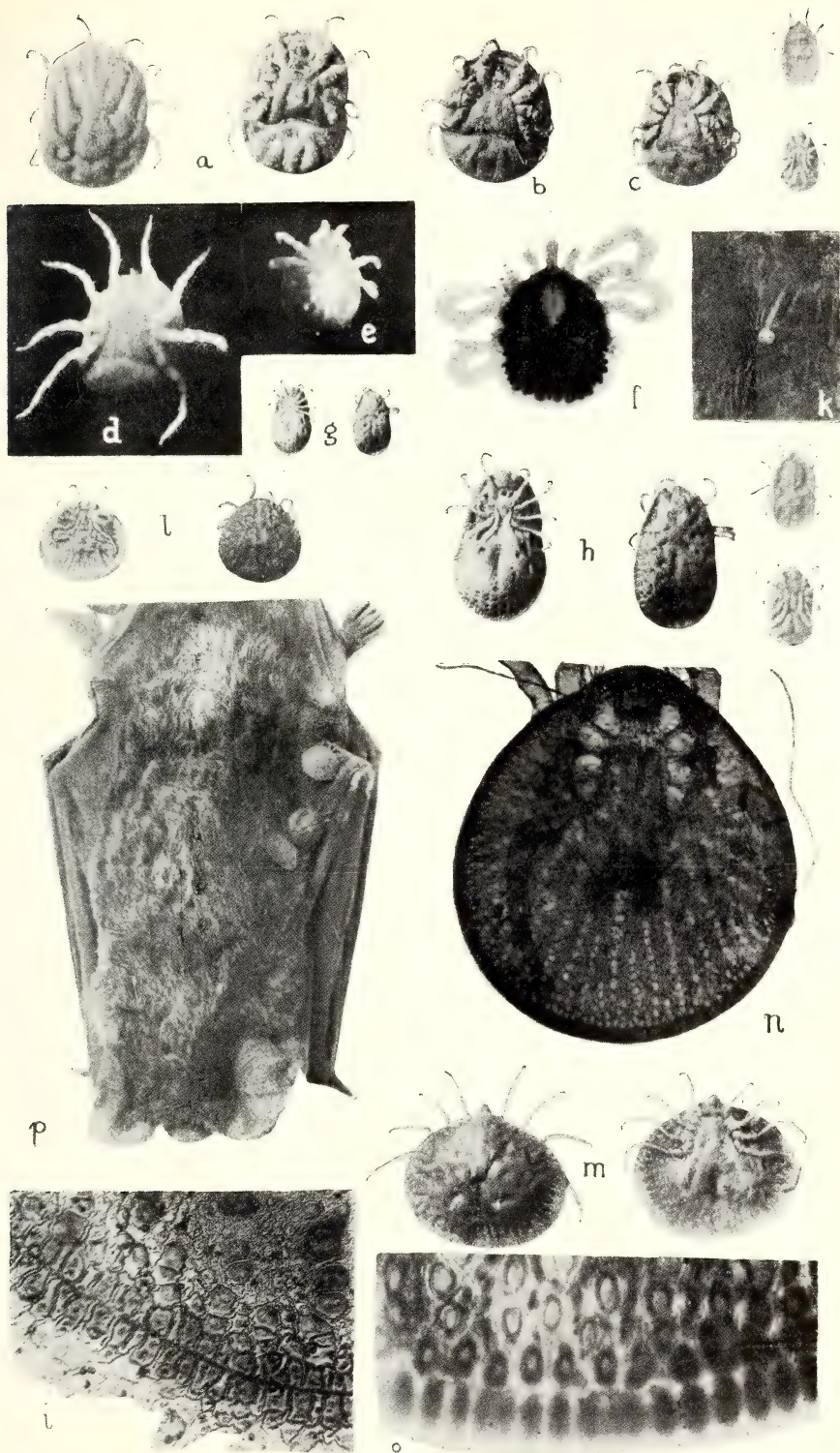


Plate I (photographs).

Ornithodoros, Argas.

Ornithodoros savignyi caecus, Neumann.

(a) Dorsal and ventral surfaces of female; (b) Ventral surface of male; (c) Ventral surface of nymph; (d) Ventral surface of nymph, just molted to octopod stage; (e) Ventral surface of larva in resting stage.

Argas persicus, Fischer de Waldheim.

(f) Larva; (g) Females (natural size); (h) Females enlarged; (i) Margin of body of adult.

Argas cespertilionis, Latreille.

(j) Larva attached to bat's wing; (k) Dorsal and ventral surface of male; (l) Dorsal and ventral surface of female; (m) Nymph, very much enlarged, showing arrangement of pits on the body; (n) Nymph, very much enlarged, showing shape of marginal pits; (o) Margin of body of adult, showing shape of marginal pits; (p) Adults feeding on a bat.

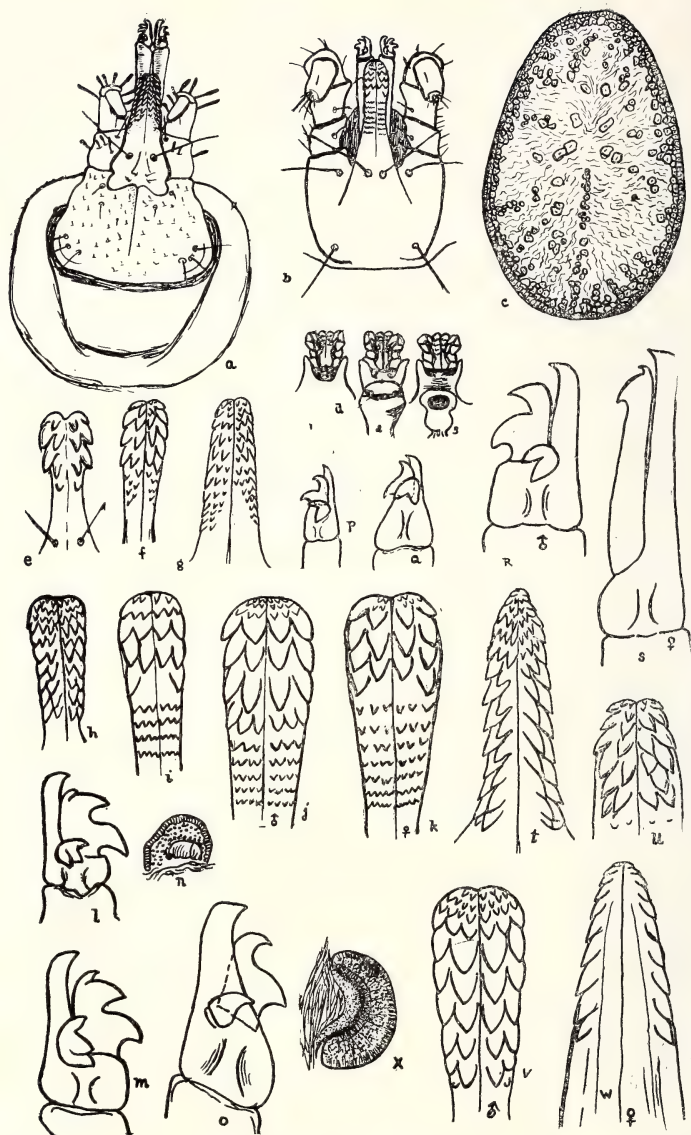


Plate II.

Ornithodoros, Argas.

Ornithodoros savignyi caecus (Neumann).

(a) Rostrum of adult.

(e) Hypostome of larva.

(f) Hypostome of nymph.

Argas persicus, Fischer de Waldheim.

(c) Dorsal surface of adult, showing arrangement of pits.

(d) Showing difference between sexual pores of (1) nymph, (2) female, (3) male (after Lounsbury).

(h) Rostrum of adult.

Argas vespertilionis, (Latreille).

(p) Mandible of larva.

(q) Mandible of nymph.

(r) Mandible of male.

(s) Mandible of female.

(g) Hypostome of adults.

(o) Mandible of adult.

(x) Stigmatic opening of adult.

(b) Hypostome of larva.

(i) Hypostome of nymph.

(j) Hypostome of male.

(k) Hypostome of female.

(l) Mandible of male.

(m) Mandible of female.

(n) Stigmatic opening of adult.

(t) Hypostome of larva.

(u) Hypostome of nymph.

(v) Hypostome of male.

(w) Hypostome of female.

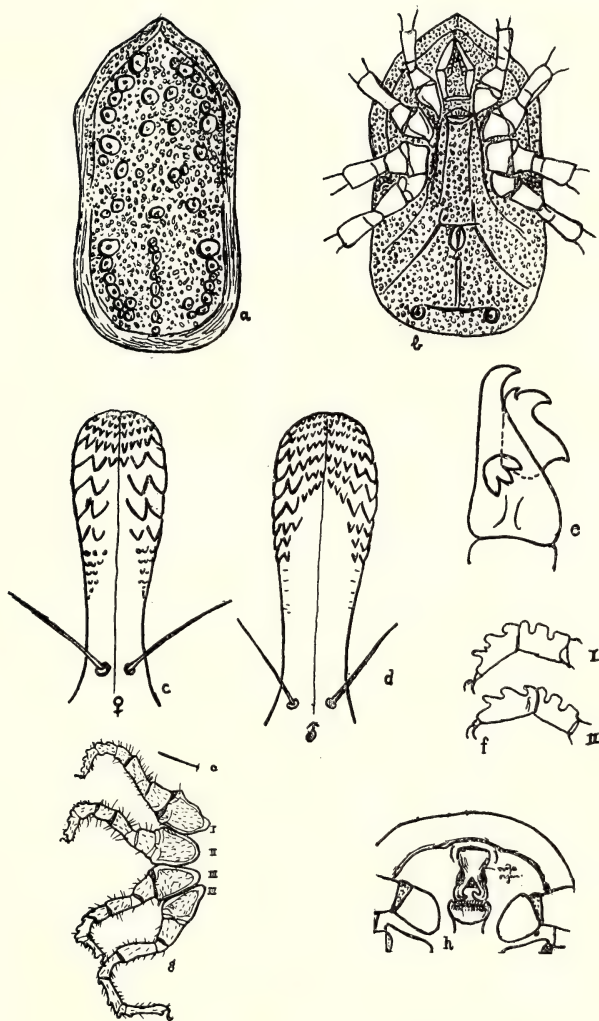


Plate III.

Ornithodoros.

O. talaje capensis, Neumann.

(a) Dorsal surface of adult.

(b) Ventral surface of adult.

(c) Hypostome of female.

(d) Hypostome of male.

(e) Mandible of male and female.

O. sarignyi parimentosus, Neumann.

(f) Tarsi I and II of adult (from Neumann).

O. sarignyi caecus, (Neumann).

(g) Legs of adult.

(h) Ovipositing organ in position for extracting the eggs.

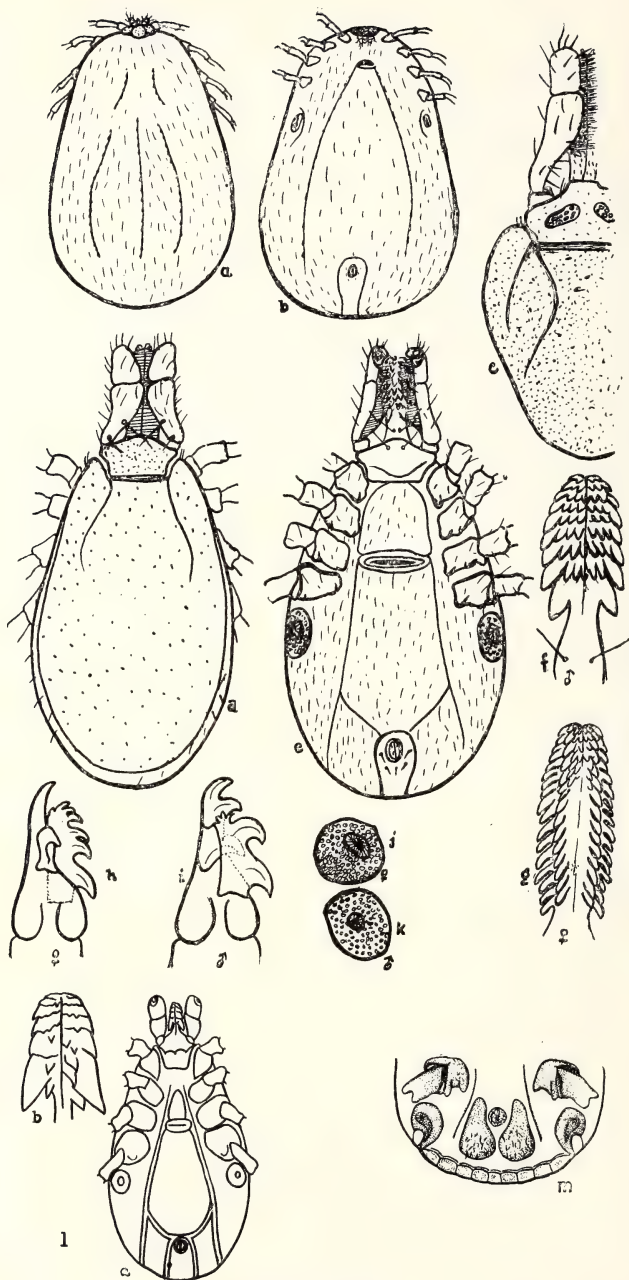


Plate IV.

Ixodes, Hyalomomma.

Ixodes pilosus howardi, Neumann.

(a) Dorsal surface of female.

(b) Ventral surface of female.

(c) Shield and rostrum of female.

(d) Dorsal surface of male.

(e) Ventral surface of male.

(f) Hypostome of male.

(g) Hypostome of female.

(h) Mandible of female.

(i) Mandible of male.

(j) Stigmatic plate of female.

(k) Stigmatic plate of male.

(l) *Ixodes rubicundus*, Neumann (from Neumann).

(a) ventral surface of male.

(b) hypostome of male.

(m) *Hyalomma hippopotamense*, (Denny), posterior end of ventral surface (from Neumann).

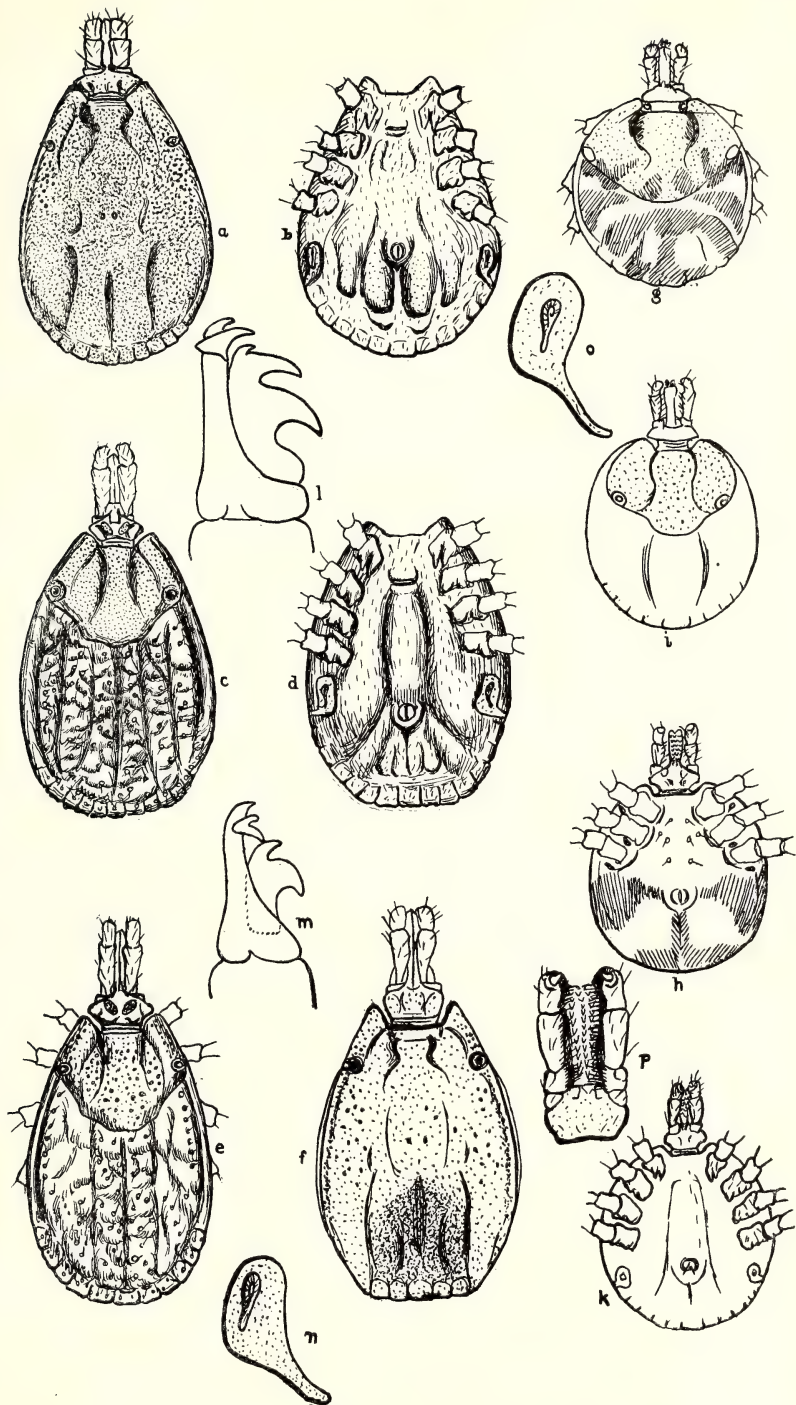


Plate V.

Hyalomma.

Hyalomma aegyptium (Linnaeus).
(e) Dorsal surface of female.

Hyalomma aegyptium impressum, Neumann.
(a) Shield of male.
(b) Ventral surface of male.
(c) Dorsal surface of female.
(d) Ventral surface of female.
(g) Dorsal surface of larva.
(h) Ventral surface of larva.
(i) Dorsal surface of nymph.
(k) Ventral surface of nymph.

(f) Shield of male.

(n) Stigmatic plate of male.

(l) Mandible of female of *aegyptium impressum*.

(m) Mandible of male of *aegyptium impressum*.

(o) Stigmatic plate of male *aegyptium impressum*.

(p) Ventral surface of rostrum of female *aegyptium impressum*.

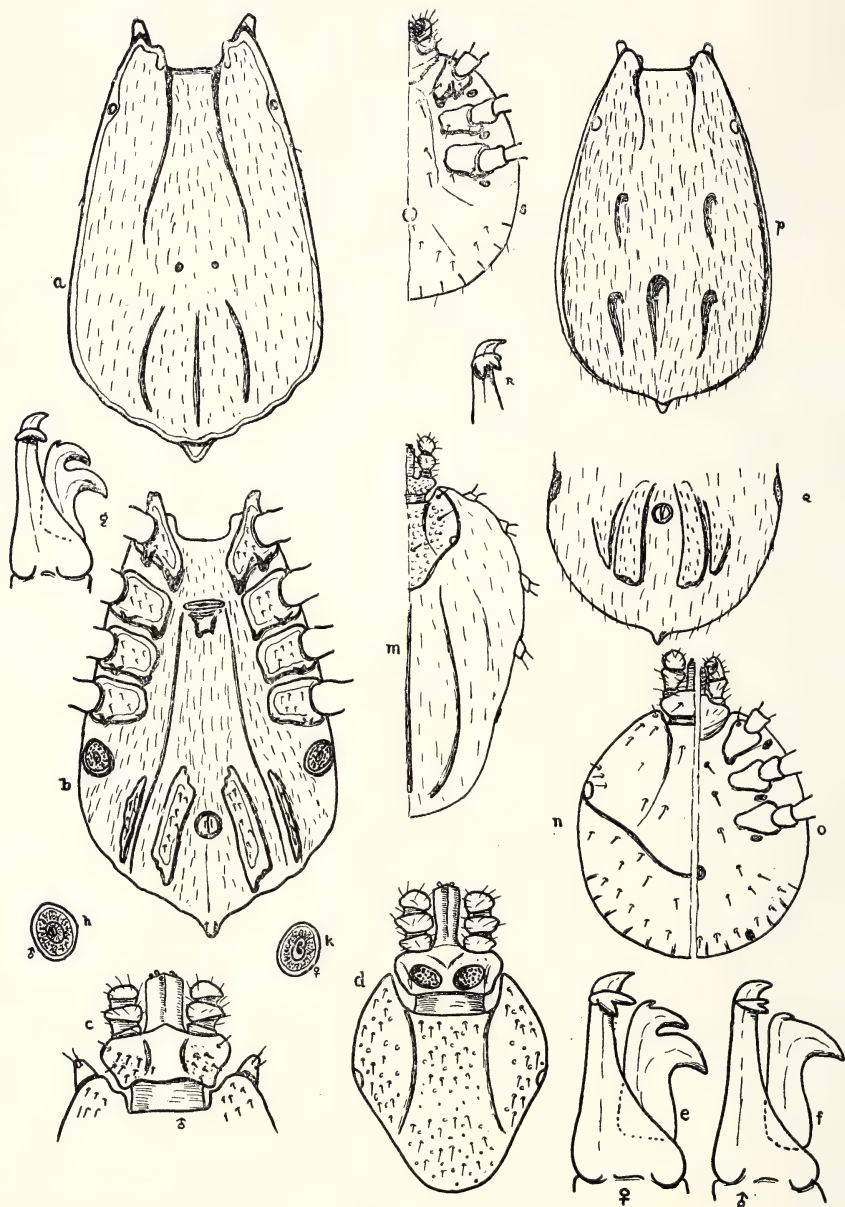


Plate VI.

Margaropus.

Margaropus annulatus decoloratus, (Koch).

- (a) Dorsal surface of male.
- (b) Ventral surface of male.
- (c) Dorsal surface of rostrum of male.
- (d) Dorsal shield and rostrum of female.
- (e) Mandible of male.
- (f) Mandible of male.

- (g) Mandible of nymph.
- (h) Stigmatic plate of male.
- (i) Stigmatic plate of female.
- (j) Dorsal surface of nymph.
- (k) Dorsal surface of larva.
- (l) Ventral surface of larva.

Margaropus annulatus australis, (Fuller).

- (m) Inner apophysis of mandible of male (redrawn from Fuller).
- (n) Dorsal surface of male.
- (o) Posterior portion of ventral surface of male.

- (p) Dorsal surface of male.
- (q) Posterior portion of ventral surface of male.
- (r) Inner apophysis of mandible of male (redrawn from Fuller).
- (s) Ventral surface of larva (redrawn from Salmon and Stiles).

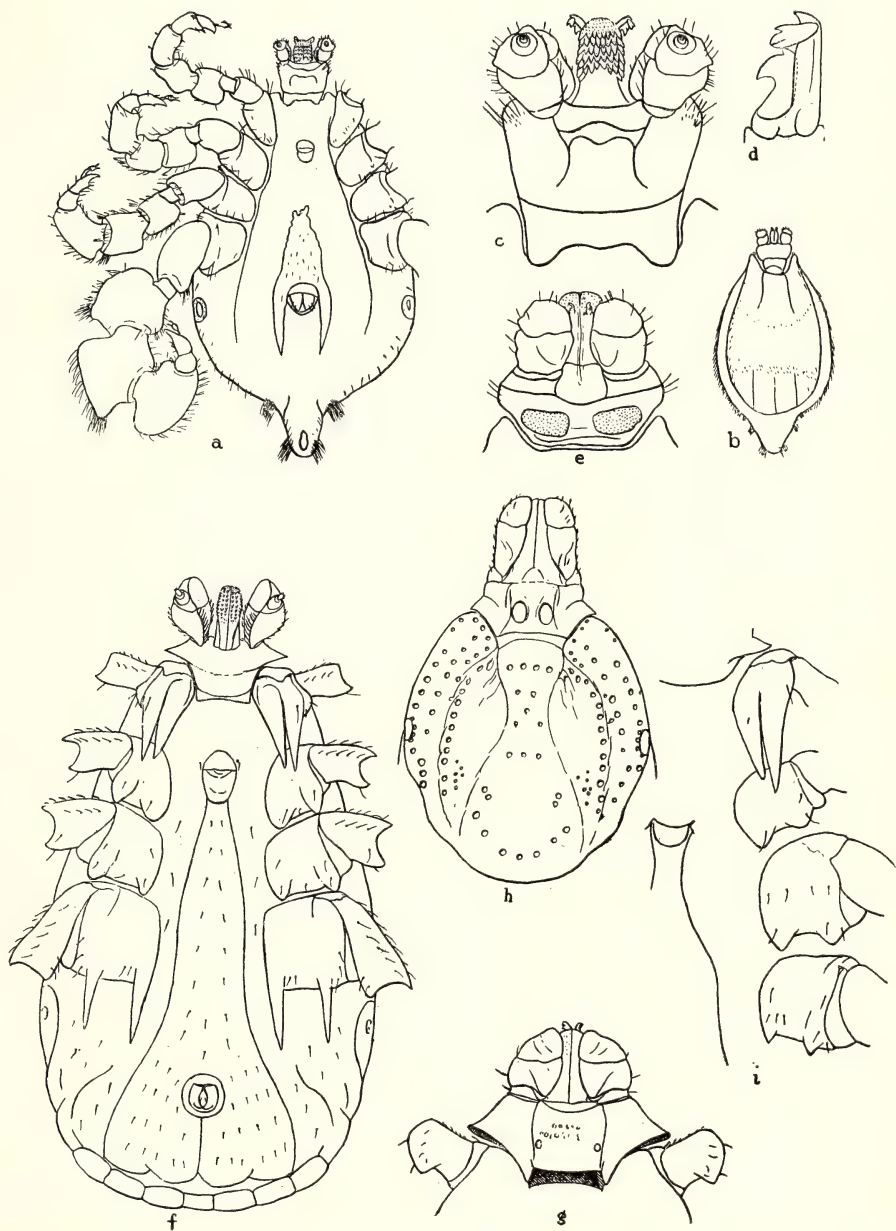


Plate VII.

Margaropus, Rhipicentor.

Margaropus lounsburyi, Neumann. (Drawings from Neumann.)

- (a) Ventral surface and legs of male.
(b) Dorsal surface of male.

- (c) Ventral surface of rostrum of male.
(d) Mandible of male.
(e) Dorsal surface of rostrum of female.

Rhipicentor ricinus, Neumann.

- (f) Ventral surface of male.
(g) Dorsal surface of rostrum of male.

- (h) Rostrum and dorsal shield of female.
(i) Coxae I to IV of female.

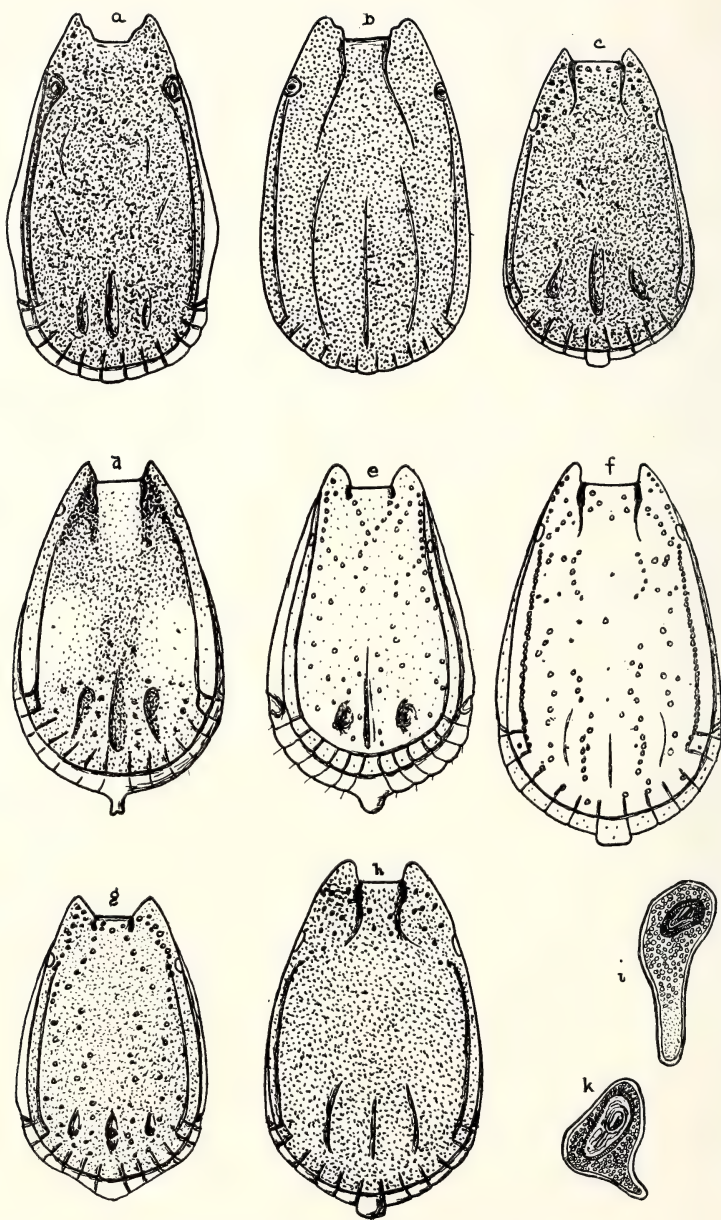


Plate VIII.

Rhipicephalus, shields of males.

- | | |
|---|--|
| (a) <i>R. erertsii</i> , Neumann. | (g) <i>R. lunulatus</i> , Neumann. |
| (b) <i>R. oculatus</i> , Neumann. | (h) <i>R. bursa</i> , Canestrini and Fanzago. |
| (c) <i>R. capensis</i> , Koch. | (i) Stigmatic plate of male <i>R. erertsii</i> ,
Neumann. |
| (d) <i>R. appendiculatus</i> , Neumann. | (k) Stigmatic plate of female <i>R. erertsii</i> ,
Neumann. |
| (e) <i>R. sanguineus</i> (Latreille). | |
| (f) <i>R. simus</i> , Koch. | |

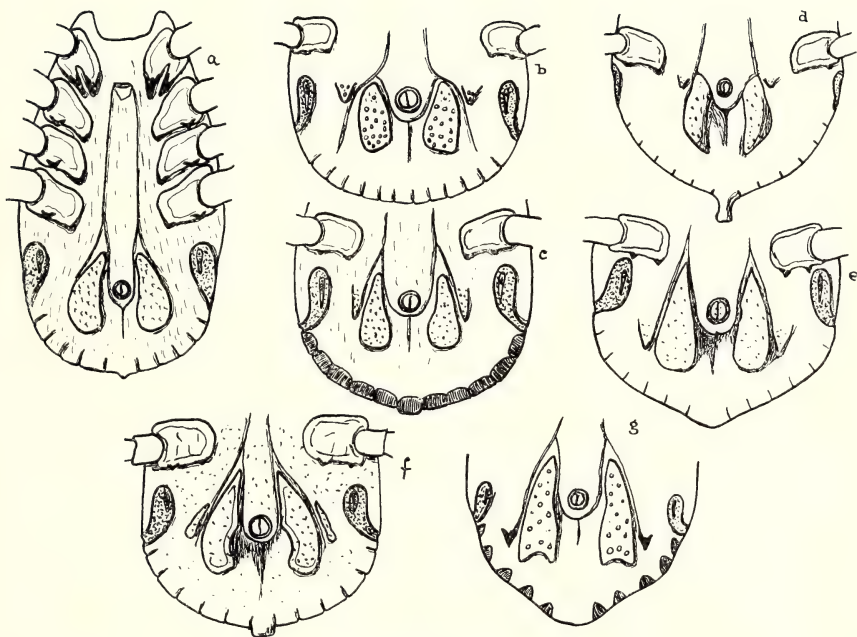


Plate IX.

Rhipicephalus, anal plates of males.

- | | |
|---|---------------------------------------|
| (a) <i>R. evertsi</i> , Neumann. | (e) <i>R. sanguineus</i> (Latreille). |
| (b) <i>R. oculatus</i> , Neumann. | (f) <i>R. simus</i> , Koch. |
| (c) <i>R. capensis</i> , Koch. | (g) <i>R. lunulatus</i> , Neumann. |
| (d) <i>R. appendiculatus</i> , Neumann. | |

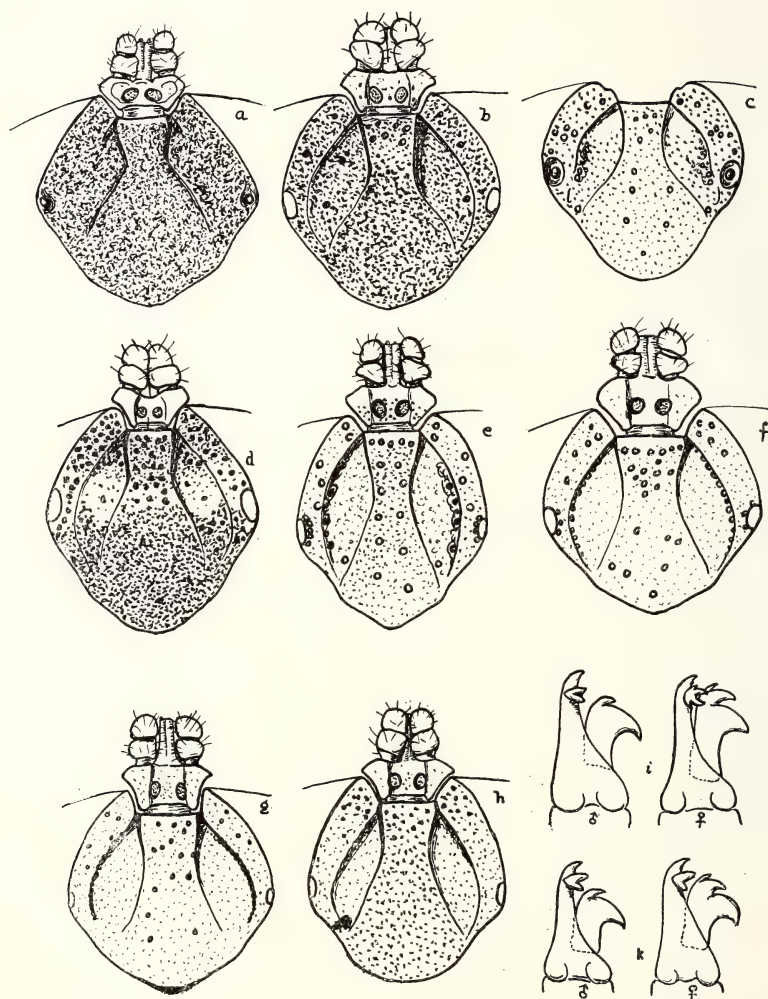


Plate X.

Rhipicephalus, shields of females.

- (a) *R. evertsi*, Neumann.
 (b) *R. capensis*, Koch.
 (c) *R. oculatus*, Neumann.
 (d) *R. appendiculatus*, Neumann.
 (e) *R. sanguineus* (Latreille).
 (f) *R. simus*, Koch.
 (g) *R. lunulatus*, Neumann.
 (h) *R. bursa*, Canestrini and Fanzango.
 (i) Mandibles of *R. simus*, Koch, male at left and female at right.
 (k) Mandibles of *R. sanguineus* (Latreille), male at left and female at right.

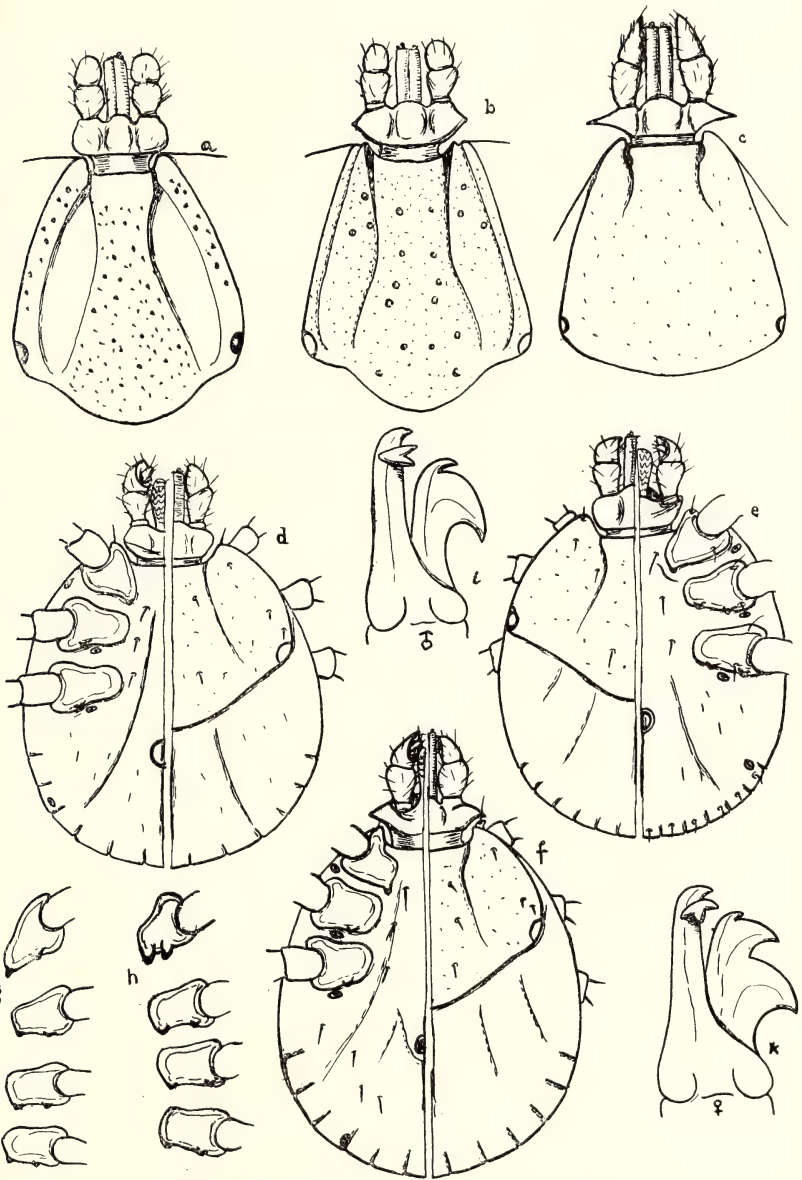


Plate XI.

Rhipicephalus, nymphs and larvae.

- | | |
|--|--|
| (a) Dorsal shield and rostrum of nymph of <i>R. evertsi</i> . | (e) Dorsal and ventral surfaces of larva of <i>R. evertsi</i> . |
| (b) Dorsal shield and rostrum of nymph of <i>R. appendiculatus</i> . | (f) Dorsal and ventral surfaces of larva of <i>R. simus</i> . |
| (c) Dorsal shield and rostrum of nymph of <i>R. simus</i> . | (g) Coxae of nymph of <i>R. appendiculatus</i> . |
| (d) Dorsal and ventral surfaces of larva of <i>R. appendiculatus</i> . | (h) Coxae of nymph of <i>R. simus</i> . |
| | (i) Mandibles of <i>R. appendiculatus</i> , male. |
| | (k) Mandibles of <i>R. appendiculatus</i> , female, nymph and larva. |

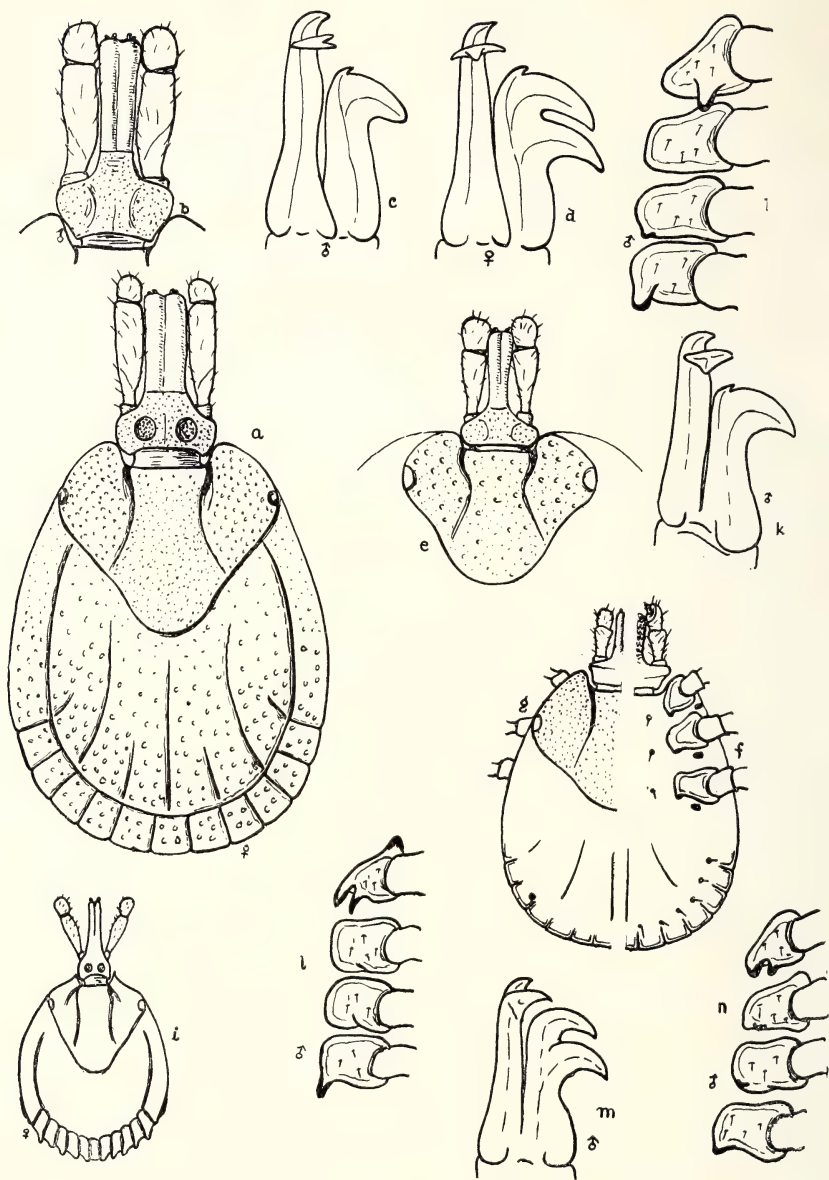


Plate XII.

Amblyomma.

Amblyomma hebraeum, Koch.

(a) Dorsal surface of unengorged female.

(b) Dorsal surface of rostrum of male.

(c) Mandible of male.

(d) Mandible of female.

(e) Shield and rostrum of nymph.

(f) Ventral surface of larva.

(g) Dorsal surface of larva.

(h) Coxae of male.

Amblyomma crenatum, Neumann.

(i) Dorsal surface and rostrum of female (redrawn from Neumann).

Amblyomma variegatum, (Fabricius).

(k) Mandible of male.

(l) Coxae of male.

Amblyomma marmoreum, Koch.

(m) Mandible of male.

(n) Coxae of male.

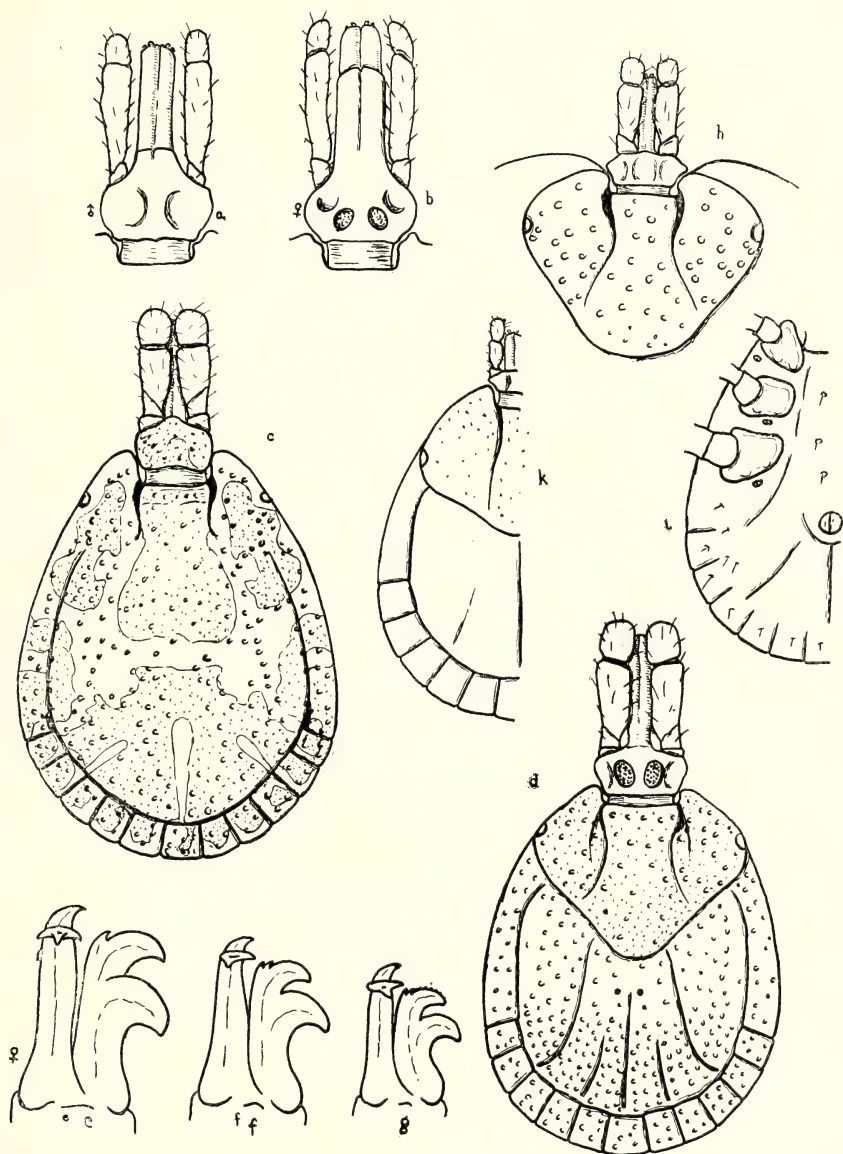


Plate XIII.

Amblyomma

Amblyomma variegatum, (Fabricius).

(a) Dorsal surface of rostrum of male (redrawn from Dönitz).

(b) Dorsal surface of rostrum of female (redrawn from Dönitz).

Amblyomma marmoreum, Koch.

(c) Dorsal surface of male.

(d) Dorsal surface of unengorged female.

(e) Mandible of female.

(f) Mandible of nymph.

(g) Mandible of larva.

(h) Shield and rostrum of nymph.

(i) Ventral surface of larva.

(k) Dorsal surface of larva.

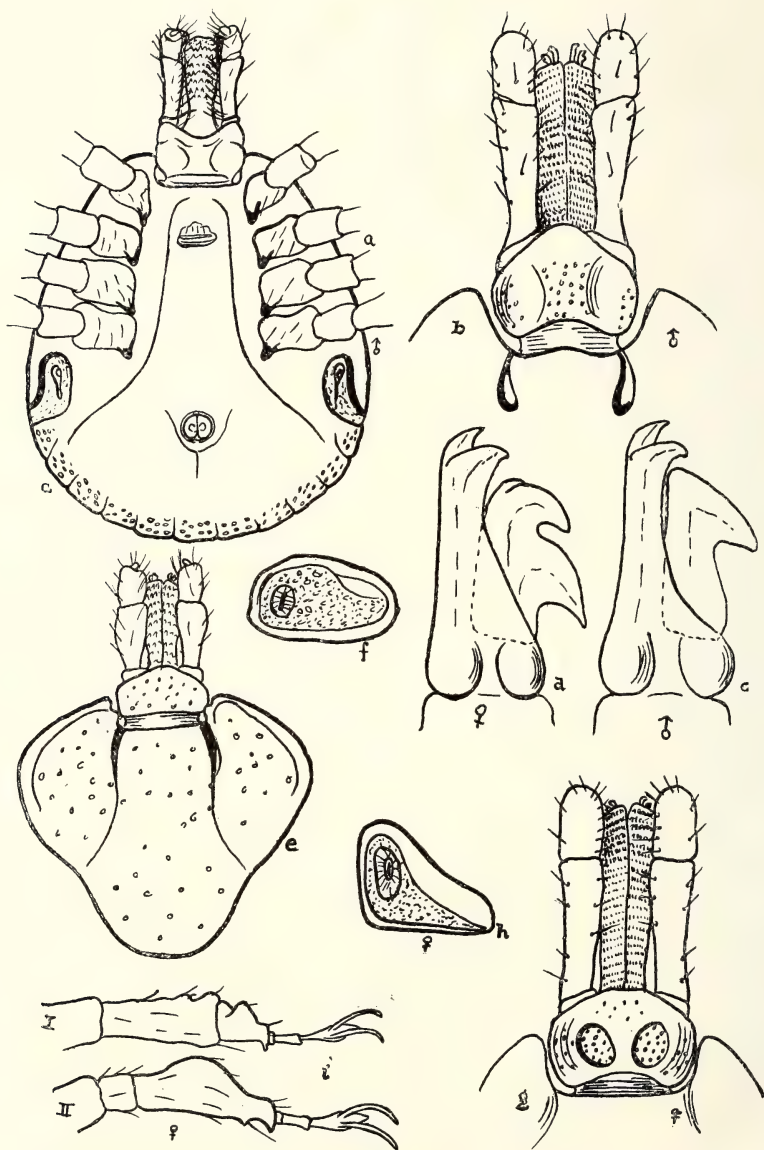


Plate XIV.

Aponomma exornatum, (Koch).

(a) Ventral surface of male.

(b) Rostrum of male, dorsal surface.

(c) Mandible of male.

(d) Mandible of female.

Aponomma.

(e) Shield of nymph.

(f) Stigmatic plate of nymph.

(g) Rostrum of female, dorsal surface.

(h) Stigmatic plate of female.

(i) Tarsi I and II of female.

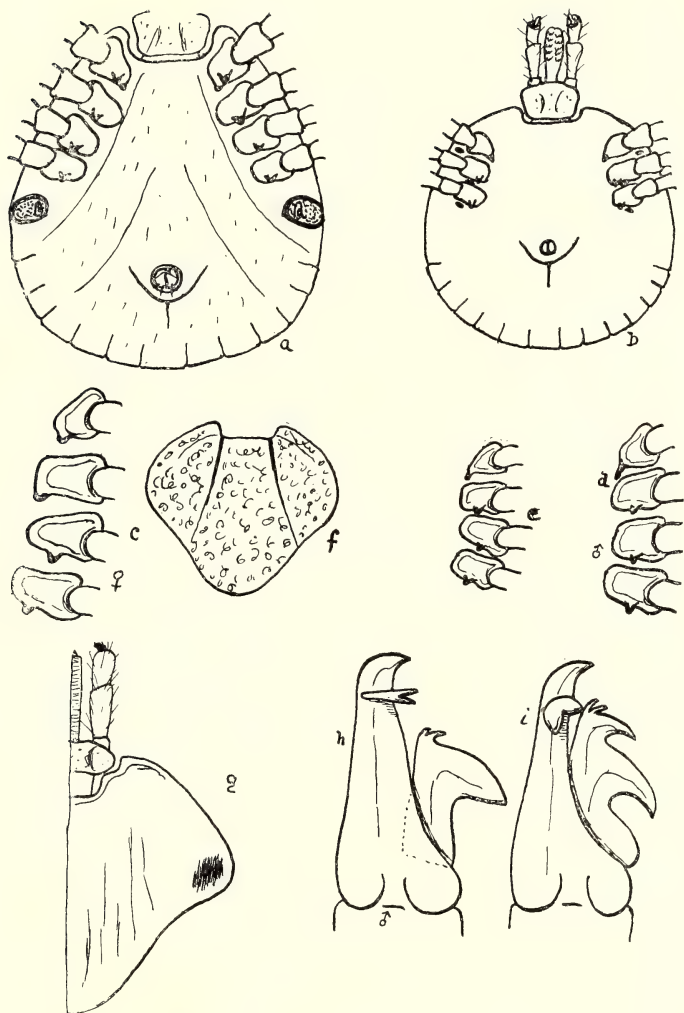


Plate XV.

Aponomma exornatum, (Koch).

(a) Ventral surface of nymph.

(b) Ventral surface of larva.

Aponomma laevis capense, Neumann.

(d) Coxae of male.

(e) Coxae of nymph.

Aponomma.

(c) Coxae of female.

(f) Shield of larva.

(g) Shield of nymph.

(h) Mandible of male.

(i) Mandible of nymph.

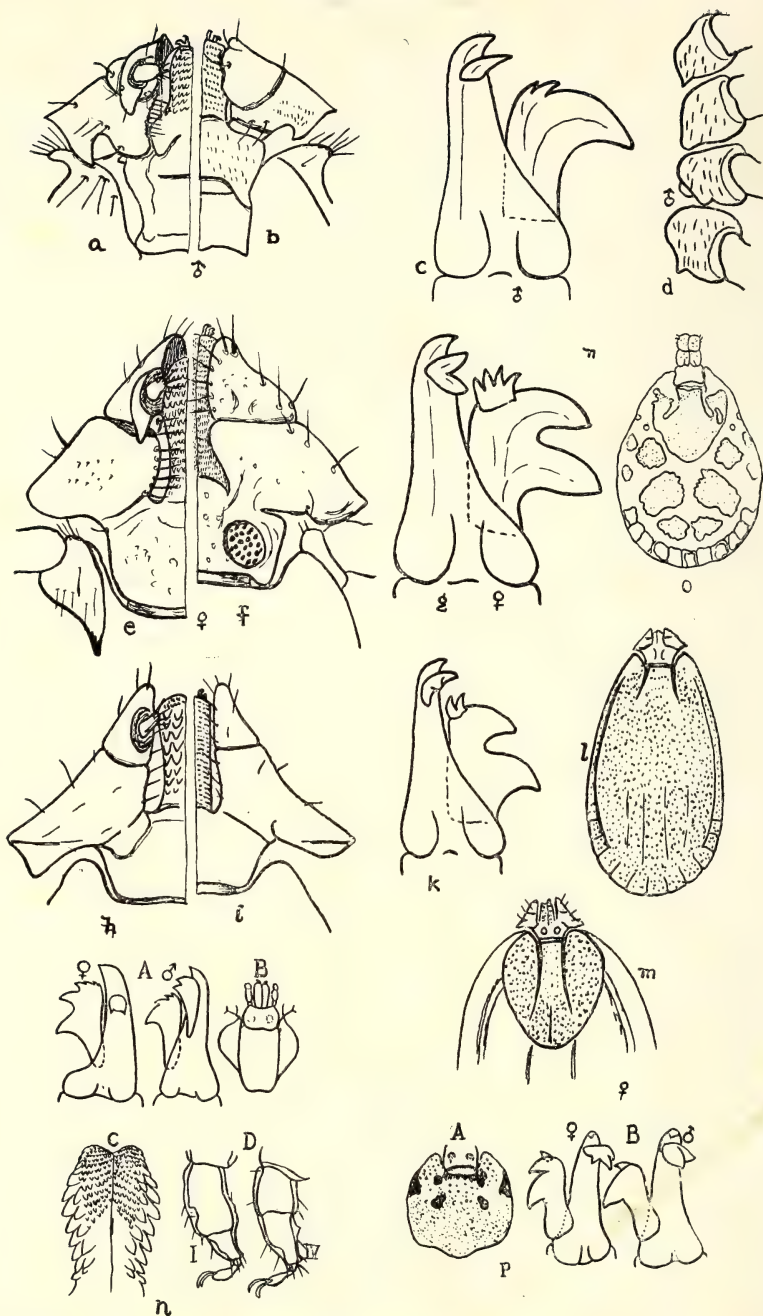


Plate XVI. **Haemaphysalis, Neumaniella, Dermacentor.**

Haemaphysalis leachi (Andouin).

- (a) Ventral surface of rostrum of male.
- (b) Dorsal surface of rostrum of male.
- (c) Mandible of male.
- (d) Coxae of male.
- (e) Ventral surface of rostrum of female.
- (f) Dorsal surface of rostrum of female.
- (g) Mandible of female.
- (h) Ventral surface of rostrum of nymph.
- (i) Dorsal surface of rostrum of nymph.
- (j) Mandible of nymph.
- (k) Dorsal shield of male.
- (l) Dorsal shield of female.
- (m) Dorsal shield of female.

(n) *Neumaniella transversale*, (Lucas), larva (from Neumann).

- (a) Mandibles of male and female.
- (b) Dorsal shield of female.
- (c) Hypostome of male.
- (d) Tarsi I and IV of male.

(o) *Dermacentor rhinocerotis*, (de Geer), dorsal shield of male (from Neumann).

(p) *Dermacentor rhinocerotis*, (de Geer), (from Neumann).

- (a) Dorsal shield of female.
- (b) Mandibles of male and female.

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